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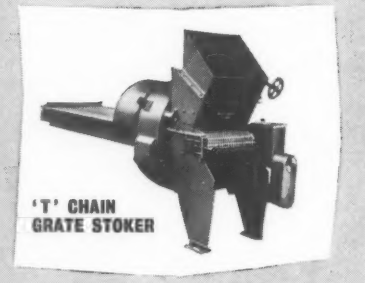

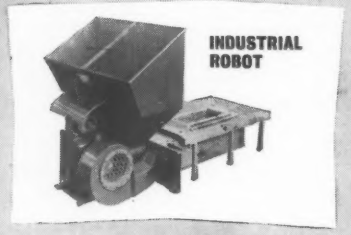

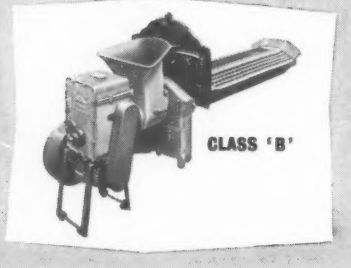

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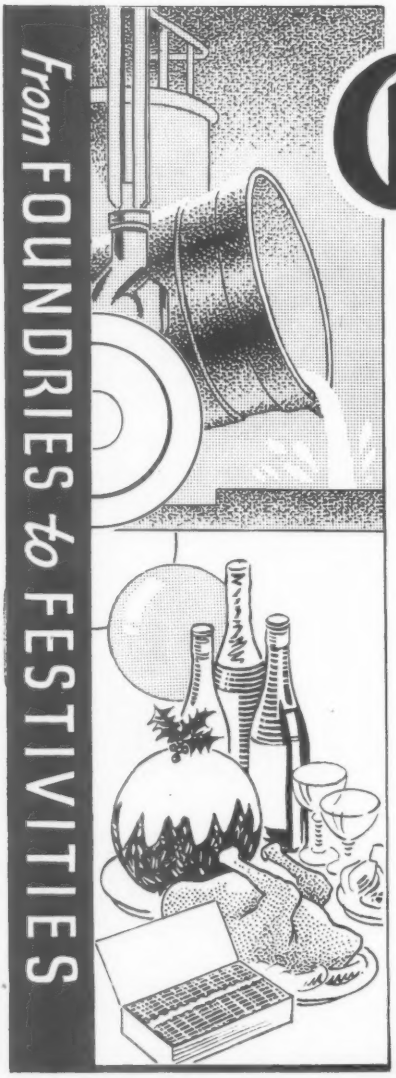

Christmas Greetings

How good it is
to greet again
The sturdy race
of Foundrymen.
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conspire
To bring those blessings
you desire,
And send you happy,
thoughtful, wise,
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to Festivities.

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FOUNDRY
TRADE JOURNAL
Vol. 105 DECEMBER 18, 1958 No. 2201

"Management and Technology"*

When one reads in the booklet "Management and Technology," recently published for the Department of Scientific and Industrial Research: "The widely accepted assumption that there are principles of management valid for all types of production systems seemed very doubtful—a conclusion with wide implications for the teaching of this subject," the statement must carry weight. This is due to the fact that the quotation was taken from the report of four trained investigators who surveyed the internal organization of a hundred firms located in South Essex. It was hoped that this research would produce findings on which the management courses at South East Essex Technical College could be appraised. Quoting again: "The danger lies in the tendency to teach the principles of administration as though they were scientific laws, when they are really little more than administrative expedients found to work well in certain circumstances, but never tested in any systematic way."

One can imagine that this was not a cheap research to undertake and, though the results were largely negative, it was well worth carrying out as it places the whole subject in its proper perspective. The head of a family business who has seen it grow to considerable proportions—a phrase synonymous with success—is perhaps the best person to consult on this subject. One observation—touched on in the pamphlet, when dealing with the quality and quantity of production—that the head of the family foundry business would make is that when a foundry becomes mechanized, the work of the foreman has to be replaced by two men or departments, for quality control and production control.

Mechanization, of course, is a major event in the development of a foundry. Yet, every notable increase in personnel or alteration in production method will demand a change—if not a new type of organization. In some industries when, over the years, a concern grows from a 10- or 20-man payroll to one having several thousands, a dozen modifications in the managerial structure will have to be made. The pamphlet reproduces an interesting diagram showing the ratio of supervisory staff to the rest of the personnel for a range of works having either 400 to 500, 850 to 1,000, or 3,000 to 4,600 employees for three different main types of production—unit, mass and process. A table for the foundry industry showing at what stages there appear the personnel, education and safety officers, the production engineer and all the other officials would be quite an interesting guide to expanding concerns. This booklet is a refreshing change from the usual collection of platitudes contained in articles about management and especially those dealing with human relations.

* "Management and Technology," by Joan Woodward is No. 3 in the "Problems of Progress in Industry" series published for the Department of Scientific and Industrial Research by H.M. Stationery Office, York House, Kingsway, London, W.C.2; price 2s. 6d.

Successor to Dr. Pearce

Mr. H. Morrogh, who for many years has been head of the research department (and lately deputy director) of the British Cast Iron Research Association, is to succeed Dr. J. G. Pearce, the present director, when he retires at the end of this year. Mr. Morrogh was educated at George Dixon Grammar School, Birmingham, and joined the staff of the Association in 1933. He was appointed senior research officer in 1942, and research manager in 1945.

MR. H. MORROGH

In his early work he made a significant contribution to metallography which enabled improvements to be made in the technique employed in the preparation of cast-iron microspecimens. He also rationalized the identification of inclusions and their mode of occurrence in cast iron. His work on graphite formation in cast iron led to a discovery which gained him an international reputation in metallurgy—the development of nodular-graphite iron, first announced in 1948.

These contributions have been recognized by the award of the Andrew Carnegie Medal of the Iron and Steel Institute (1946); the E. J. Fox Medal of the Institute of British Foundrymen (1951); the W. H. McFadden Medal of the American Foundrymen's Society (1952), and the Sir Robert Hadfield Medal of the Iron and Steel Institute (1956).

Mr. Morrogh has had considerable experience as a lecturer on metallurgical subjects. Amongst his published works may be cited a total of 15 technical contributions, which includes, in addition to those published by the Association, papers to the above-mentioned Institutes and Societies.

Correspondence

ALTERNATIVE METHODS OF PATTERN CONSTRUCTION

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—In these days of increasing necessity to reduce casting production costs, is not "Chip" tending to confuse us? In his article "Alternative Methods of Pattern Construction," he advocates the construction of a laminated pattern where 12 castings only are required, suggesting that such would be economical by saving moulding time. Surely, the increased time expended by the moulder to "stop off" the strengthening ribs would be small compared with the additional patternmaking time and cost.

"Chip" also makes reference to a tongue and groove jointing of the three pieces of timber used for the simple pattern; again, particularly in view of the strengthening webs, simple glued joints would be adequate. It is further stated that the pattern with ribs necessitates a deep stepped joint as shown in figure "b." This is not a fact and the pattern could equally well, if not better, mould as shown in figure "f," as the webs could then be withdrawn vertically from the convex face of the mould.—Yours, etc.,

J. PLAYLE.

19, Main Road, Jacksdale, Notts.
December 9, 1958.

NOTABLE STAINLESS-STEEL CASTINGS

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—Your correspondent, Mr. S. L. Roberton, is quite correct in his letter to you of November 27 in stating that the photographs shown on page 386 of your issue of September 25 are not the largest stainless-steel castings ever produced. From our information, however, they are the largest-bore valve-body and -cover castings of their type to be made in stainless steel.—Yours, etc.,

W. H. WENTWORTH PING,
Sales Development Manager.

Firth-Vickers Stainless Steels, Limited,
Sheffield.
December 8, 1958.

Latest Foundry Statistics

Steel Castings: The average weekly production of steel castings during October was 5,300 tons. This figure is published in the monthly *Bulletin* issued jointly by the Iron and Steel Board and the British Iron and Steel Federation. It is the lowest output returned for many years. Employment decreased also. On October 4 there were 18,620 employed in the steel-founding industry, and this is 200 fewer than a month earlier.

Introducing the Author

Mr. P. A. BROADBENT, whose recent paper to the Institution of Mechanical Engineers appears on the facing page, is works manager of the Phosphor Bronze Company, Limited. Educated in the Isle of Man, he served an indentured apprenticeship in Birmingham with Belliss & Morcom, Limited, supplemented by the mechanical-engineering course (with foundry endorsements) at the Birmingham Central Technical College. Then followed four years at Rugby with the British Thomson-Houston Company, in the turbine and motor-generator factories. This was augmented by his taking the electrical-engineering course at the Rugby School of Technology. In 1943 he was seconded to the contracts department of the Ministry of Aircraft Production and later to a production department of the Ministry of Supply. In 1947, he joined Bryant & May, Limited, as assistant to the chief engineer.

Mr. Broadbent returned to the Midlands in 1949 as technical assistant to the works director of Sterling Metals, Limited, Nuneaton, until February, 1958, when he joined Birfield Industries, Limited, as foundry project engineer, until his promotion in November to his present position with the Phosphor Bronze Company, a producer company in the Birfield group.

THE SWEDISH iron and steel concern of Domnavets Jernverks AB recently brought into operation an electro-steelworks with a charge capacity of up to 100 *tonnes* daily. It is reported to be the largest works of its kind yet to be built in Sweden.

Economic Design of Light-alloy Castings*

By P. A. Broadbent

Light-alloy castings can already be produced to consistently close limits by well-established die-casting methods, so the post-war developments of precision moulds are of more benefit to the other non-ferrous and ferrous foundry industries. Furthermore, the special light-alloy foundry techniques, the heat treatment and other processes, and the free-cutting properties of light alloys should be related to design and costs of production. Test-bar specifications for a number of aluminium and magnesium alloys are given, and are discussed in relation to strength and weight of castings, and also to certain features of design, and to the cost of a machined casting in cast iron and various light alloys. High-tensile steel bolts are necessary to shear screw threads in light alloys, and results of tensile tests on inserts and fastenings are given, together with estimates of cost of each method of assembly. Where inserts and fastenings are used, precautions to avoid galvanic action between dissimilar metals are necessary only on exposed junctions, whilst for corrosion generally, precautions are just as necessary for the common light alloys as for the common iron and steel constructional materials and components.

Expanding markets and increased production have brought about more rapid movement of machinery and material, resulting in greater use of light alloys to reduce weight of mechanisms, to permit easier and more rapid handling of materials, and to reduce machining times. Light-alloy castings are being introduced into a wide variety of industries and it is understandable in these days of specialization if all the technicians in these industries are not conversant with light-alloy foundry techniques, or even the design and application of light-alloy castings, and that they hope to learn by studying technical reports, literature, and lectures, issued and given by research and development departments, trade associations, and suppliers to the foundry trade. Whilst these reports are welcome and useful, as with most industries, the foundry trade has developed over the years to become a specialist field often cultivated to serve one particular industry or even one organization, and their investigations are quite naturally aimed at serving their own purpose, so it does not follow that success in one sphere will become the panacea for supply and production problems in another.

This applies particularly in the light-alloy foundry trade where sand moulds, gravity dies, and pressure dies are well established and economic methods of producing accurate high-quality castings competitive with most of the post-war developments. These latter deal mainly with the methods of moulding in shell form, using resin-bonded sand or ceramic materials, with patterns of wax or frozen mercury, and preparing sand or plaster moulds by chemical process instead of heating and baking, and their main objective is to produce shapes sufficiently accurate to reduce or even eliminate machining. The methods used since 1945 are particularly successful in casting ferrous alloys which hitherto were difficult, if not impossible, to shape by forging or machining, but these difficulties do not apply to light alloy.

It is not the purpose in this paper to discuss the relative merits of the various methods of producing castings, but rather to deal with design considerations for light-alloy castings not always appreciated by the designer, production engineer, and the founder.

Casting Tolerance

One of the first requirements of any component is dimensional accuracy and consistency. In casting specifications, founders often claim two tolerances: a low figure for dimensions within each part of the pattern, and a larger figure for dimensions across a joint in the pattern or mould, to allow for expansion or movement of each part of a mould or core assembly. To be of real value this necessitates advice from the foundry on the position of joint lines—always to be recommended but not so expedient if several foundries are to be consulted to obtain the most competitive terms before placing an order for a small batch. Therefore it is recommended that the larger tolerances, that is, across the joints, be adopted throughout the drawing, for, in intricate designs, the joints may be so numerous that to have selective tolerances would only complicate the drawing.

Though wall thickness is often a criterion for control of weight, dimensional accuracy, and cost of castings, and though many designers insist on a plus and minus tolerance on their drawings, it should only be used as a guide, because a casting

* Paper presented at the ordinary meeting of the Institution of Mechanical Engineers on November 7, and reprinted by courtesy of the Institution. Particulars of the Author's career are recorded on the facing page.

wall may be built up by a variety of components in the mould such as loose pieces in the pattern, metal chills and a sand-mould face, or a number of cores. The resulting thickness may vary, not only within the same wall but with other walls of the same casting, and also with similar walls of the same batch of castings, and consequently it would not be economic to adhere strictly to any given dimensional tolerance.

However, for the benefit of those who think that tight dimensional tolerances on a casting drawing means close control of casting accuracy, the author has taken a number of spot checks over a period of years on batches of aluminium and magnesium shell-moulded castings formed from 12-in. square dump boxes, and it appears that the variation from any major dimension of a drawing may be expected to economically fall within +0.020 and −0.010 in., this being made up of +0.010 in. to nil owing to limitations of pattern equipment, whilst the casting from that pattern varied ±0.010 in.

Contraction

In all cases, ferrous or non-ferrous, sand, dies, or investment castings, the first stage depends on the skill of the pattern or die maker in assessing the allowance to be made on any given drawing dimension for expansion of the die, and contraction of the casting metal during transition from the molten state to normal room temperature. Though standards of contraction are known for various alloys they may only be used as a guide because obviously a long slender casting free to contract will do so much more readily than a stocky, intricate casting of the same weight and alloy, and the amount of skill used will only reduce, and not eliminate altogether, the trial and error methods so common, yet so necessary, in foundry practice.

Variation in the rate of dissipation of heat content of the molten casting, causing variation in contraction rates, may be brought about in the first place by different thicknesses and projections in a casting as designed, secondly, by the flow of metal forming hot or cold spots in the mould, and, thirdly, by variation of pouring temperature, particularly in production foundries where one melt serves a number of moulds.

Pattern Draft

A basic source of dimensional variation is the taper or draft angle to be allowed in order to withdraw the pattern from the mould, or the casting from the die. A taper of 1 deg. is 0.017 in. per in. length, and whilst this amount may not be necessary on small shallow castings it certainly would be required on larger castings of any 6-in. depth, and also for large production runs, to avoid time lost in repairing damage to the walls of a mould caused by dragging the pattern during its withdrawal.

This taper can be completely eliminated if necessary by the use of extra cores (sometimes from rubber-faced core-boxes) or special moulds of plaster or similar material but, unless the machining of the face in question is eliminated altogether, the extra cost of this equipment may not be justified. This applies particularly to light-alloy castings which can be machined so easily.

Cores

The variation across joints mentioned earlier refers not only to pattern joints but also to joints between core and mould, and also between adjacent cores, whilst the location and support of cores has a very great influence on dimensional stability.

Designers can help by the elimination of narrow necks and sections in the cored shape and also by the provision of adequate body in the core for vent tubes and stiffening wires. Though cores can be supported from one end—cantilever fashion—a support at both ends will considerably reduce the possibility of deflection, as any student of beam loading may realize, while an even better support would be one taking the weight of the core through the wall of the casting, particularly for long slender cores.

In the die foundry, cores and their location can be quite a problem, because generally they are made of metal and must be withdrawn before the casting has time to contract on to it, and for this reason a generous taper is desirable. This further upsets dimensional tolerance unless collapsible cores are used, though even they are not a complete remedy, and only further complicate die design and operation.

Fettling

It is not sufficient to make precision patterns and moulds to produce precision castings, the same care must be taken during subsequent stages of production, particularly with light-alloy castings, to avoid stresses and distortion during fettling, heat treatment, and sometimes during machining and inspection operations, and even in handling through the works.

Every joint in the mould will at least leave mark which has to be removed in the fettling shop. That is where lost-wax and similar processes using jointless moulds have some advantage, but, of course, the larger the surface area, or the more complex a casting, the greater the need for a joint somewhere. Even without a joint, the metal has to be fed into the cavity from which air and gas must be free to escape, and, in the case of light-alloy castings of high metallurgical quality, the feeder heads need to be very much larger than is usual for iron castings, causing considerable fettling and trimming during removal.

The fettling, trimming, and polishing of a casting needs greater care with light alloy because the free-cutting properties of magnesium, for instance, allows about only one-sixth of the time available for ferrous alloys for the operator to react to any errors of judgment.

Economic design should strike a balance between the cost of extra metal to avoid projections and recesses, and the cost of making and handling cores, loose pieces, chills, etc., and of removing the marks all these make on castings.

Machining

In some cases the variation between so-called precision castings is too great to obviate machining altogether and, whereas the reduced machining allowance may lessen the time required to machine ferrous metals to, say, one cut, a similar advantage may not be gained in the case of light alloys, because their free-cutting properties may quite well result in machining time being considerably less than the handling times.

Magnesium may be turned twice as fast as aluminium and ten times as fast as steel. For example, the surface of magnesium billets is removed with ¼-in. depth of cut at a traverse of 27 in. per min. with a spindle speed of up to 3,000 rev. per min. at a surface speed of 7,000 ft. per min.[1] However, there are few castings shaped like a billet, but if designers cannot accept the inevitable slight variation of relatively expensive close-tolerance light-alloy castings, it may be more economic and quicker to call for sand casting, and spend the money on special-purpose or automatic machine tools.

Further examples of the free-cutting properties of light alloys are given in the paragraph dealing with bosses and pads and again in Table 4.

Whilst on the subject of machining magnesium, it might be interesting to note that tests carried out with ceramic-tipped tools in the works with which the author was formerly associated reveal that the tip soon loses the sharp edge so necessary when cutting magnesium and, although the tip remains cool, the ribbon swarf produced creates a much greater fire hazard than the swarf chips from a carbide-tipped tool, which are much easier to control and clear. Because of the high rate of production and because of its lightness, magnesium swarf clearance presents problems to the machine-tool designer not met with in other metals, so again, as in the foundry world, developments in the machine shop since 1945 are not so readily applicable to magnesium alloys.

Heat Treatment

A study of the variations of the Birmidal alloys in Table 1 shows how the strength of certain light-alloy castings is improved considerably by single-stage heat treatment—producing ductility—and two-stage heat treatment—producing rigidity. Generally speaking the heat treatment ranges from 2 to 24 hr. and from 170 to 540 deg. C., but it should be noted that the heat-treatment temperature of some alloys is only about 25 deg. below the solidus (the temperature at which the metal starts to melt) and hence for several hours the castings are in almost a plastic state, and in the case of aluminium alloys, this is followed by a quenching in oil or water. Magnesium alloys do not require this shock treatment, and it is rough treatment for a casting expected to remain accurate to a few thousandths of an inch.

It must be appreciated that when a casting is removed from the heat-treatment stove it is at a uniform temperature, but as soon as quenching

TABLE 1.—*Mechanical Properties of Various Sand-casting Alloys.*

Trade name.	Specification.			Heat treatment reference	Minimum tensile strength.		Elongation, per cent. on 2 in. gauge length.	Notch impact Izod, ft. lb.	General properties.		
	General.	DTD	BS		0.1 per cent. proof, tons per sq. in.	Ultimate, tons per sq. in.			Foundry class.	Maximum working temperature.	Pressure tightness.
Aluminium alloys.											
	LM.4	424A	—	M	4.0	9.0	2– 3	1.0	A	B	A
D.8	—	424	—	W	5.5	11.0	2– 3	1.3	A	B	A
D.8	—	424	—	W.P	16.0	17.0	0	0.5	A	B	A
Birmabright ..	LM.5	165A	—	M	5.0	9.0	3– 6	5.8	B	B	C
Alpax ..	LM.6	—	3L33	M	3.0	10.5	5– 8	4.5	A	C	A
Alpax Gamma	LM.9	245A	—	P	13.0	15.5	0– 2	0.9	B	C	A
	LM.11	298A	1490	W	8.0	14.0	7–10	10.0	B	200	C
	LM.11	304A	1490	W.P	11.0	18.0	4– 6	3.4	C	200	C
	LM.10	300	L.53	W	9.5	18.0	8–12	10.0	C	200	C
"Y" ..	LM.14	—	2L35	W.P	12.5	14.0	0– 1	0.6	B	300	C
RR.50.. ..	LM.23	133	L.51	P	6.5	10.0	2– 4	1.6	B	200	A
Birmidal ..	LM.8	716	—	M	4.5	8.0	2– 3	1.1	A	B	A
Birmidal ..	LM.8	722	—	P	8.0	9.5	0– 1	1.2	A	B	A
Birmidal ..	LM.8	727	—	W	6.0	10.5	2– 3	2.6	A	B	A
Birmidal ..	LM.8	735	—	W.P	13.0	15.0	0– 1	1.4	A	B	A
Magnesium alloys.											
Commercial ..	—	—	—	M	4.5	8.0	0– 2	0.5	A	100	B
Commercial ..	—	—	—	W	4.0	12.0	4– 8	3.0	A	100	B
Commercial ..	—	—	—	W.P	6.0	12.0	0– 2	0.6	A	100	B
A.8	1277	59B	L121	M	4.5	9.0	2– 3	1.1	B	100	B
A.8	1278	289	L122	W	4.0	13.0	6–10	4.0	B	100	B
ZRE.1 ..	—	708	—	P	5.5	9.0	3– 5	1.0	A	250	A
Z.5.Z	—	721A	—	P	8.5	15.0	5–10	2.0	C	150	C
RZ.5	—	748	—	M	8.0	13.0	3– 5	1.0	A	100	B
ZT.1	—	5005	—	P	5.5	12.0	5– 8	1.5	A	350	A
TZ.6	—	—	—	P	9.0	16.5	5–12	1.5	A	150	B
AZ.91 ..	1273	—	L123	M	5.0	8.0	0– 2	0.5	B	100	B
AZ.91 ..	1274	—	L124	W	4.5	13.0	4– 8	2.5	B	100	B
AZ.91 ..	1275	—	L125	W.P	7.0	13.0	0– 2	0.8	B	100	B

begins the temperature is different in almost every part of the casting owing to:

(1) the heat capacity of thick sections being greater than thin sections, and

(2) the rate of cooling being affected by the shape or surface.

Flat surfaces dissipate heat at about the same rate at which it is received; external corners, ribs and bosses, dissipate heat at considerably more than the rate at which it is received, whereas internal corners and recesses must dissipate heat at considerably less than the rate at which it is received from the main body of the casting. However, it is unreasonable to expect designs without corners, recesses, ribs, and bosses, so the foregoing is intended to show that the need for flowing lines in casting design is not only to facilitate the flow of metal through the mould, but also to allow uniform dissipation of heat and avoid distortion of the casting.

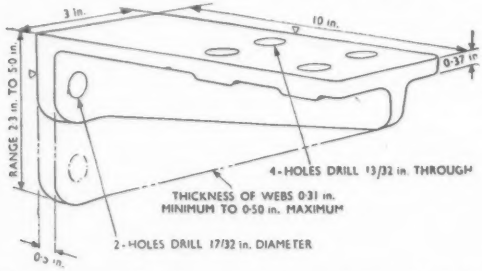

FIG. 1.—*Bracket casting used to assess data in Tables 3 and 4 (materials used were aluminium, magnesium, and cast iron, respectively).*

The advantages of higher strength by heat treatment far outweigh the disadvantage of possible dimensional variation. Care and skill in the heat-treatment department can obviate the need for expensive heat-treatment fixtures which take a long time to produce, a lot of room in the stove, a long time to warm up and cool down, and yet still require skill in design and operation to ensure that they do not impose more, and different, stresses than they are intended to relieve. In the works with which the author was associated a total of approximately 30,000 aluminium and magnesium castings, ranging in size from 1 oz. to 1,000 lb., is heat treated per month without the use of fixtures, and only occasionally are formers used.

Metallurgical Soundness

Obviously heat treatment will only improve the strength of sound material. It cannot remedy defects produced in the mould during solidification such as:

(1) Blowholes caused by dirt, excessive moisture in the mould, or gas in the metal being trapped during solidification;

(2) cold-shuts caused by two streams of metal, travelling through tortuous passages of a thin-walled design, being too cold to knit together when they meet at the end of their journey;

(3) coarse grain and hot-tears caused by uneven rate of cooling;

(4) incorrect balance between chill and feed.

Whilst these defects may be the responsibility of the foundry to remedy, designers can help again by introducing smooth flowing lines in their design.

Choice of Alloys

There are about 40 magnesium and aluminium alloy specifications in commercial use, but this selection is often reduced to less than six, because some of the alloys are used only for special purposes, or because the designer is prejudiced against certain alloys, or else he is ignorant of the full selection available. It is recommended therefore that the designer should specify not one individual alloy, but a group of alloys having similar properties to meet the design specification of strength, or temperature, or pressure tightness, from which the founder may select the one best suited to his own circumstances, such as availability of supplies, his own experience in handling the different alloys, and the desirability of limiting the number of alloys in use in any one foundry.

Test data and mechanical properties, some of which are listed in Table 1, vary between foundries above the specified minimum, which should only be used as a guide, because it must be appreciated that these figures are derived from the ideal design—a cylindrical test bar, machined all over, and produced from a simple mould which provides for adequate feeding of molten metal, without restrictions, thus ensuring soundness and consistency of results—and very few castings designed for production meet these conditions. An example of the difference between strength of casting and the strength required by specification is shown in Table 2, but it cannot be too strongly emphasized that the results refer only to castings of similar type, section change, and size.

However, it is interesting to note that:

(1) Cast sections are nearer to the quoted figures for 0.1 per cent. proof stress than for ultimate stress, and consequently the former may be regarded as a more reliable basis for stress calculations;

(2) the variation in strength between founders, and throughout the casting, is shown by the difference between average minimum strength (the lowest average recorded from the same section of a number of castings from one supplier), and the average mean strength throughout the design (average of all castings supplied by founders of that alloy), and

(3) of the higher-strength aluminium alloys the DTD 298/304 series is nearer in casting design to the specification than the DTD 300/L.53 series, and consequently the former provides a more reliable basis for stress calculation.

Furthermore, the use of special alloys may not be as economic in general engineering as in the aircraft industry, nor may space and weight be so restricted, so that by slightly increasing depth of section (and of course width to suit foundry requirements) to give higher values of "Z" or "I" as required by the loading, a compromise between weight saving and

costs may be achieved to satisfy design, foundry and sales requirements. This is demonstrated in Table 3, which shows the relative size, weight, and value of a light-alloy casting under static load, made from various alloys, but it must be remembered that specification of strength is not the only criterion for choice of alloy.

Resistance to impact, thermal change, or pressure may have more bearing on the choice technically, whereas machining costs and capacity may influence the choice economically. This is illustrated in Table 4 which shows the relative weight, dimensions, and value of the bracket shown in Fig. 1 proof stress under static load with due regard to the foundry properties, the elongation, and notched Izod values for the various alloys. Further allowance should be made for different load conditions.

Risers or Feeder Heads

The earlier remarks about the rate of cooling of castings after heat treatment and during quenching apply equally well to the setting of the molten metal and the cooling of the casting in the mould. It must be remembered that a casting cools from the surface inward, and at an ever-increasing rate in

TABLE 2.—*Strength of Casting, Related to Test-bar Specification, for Various Alloys.*

—	Test bar specification. Range, tons per sq. in. Proof.	Test bar specification. Range, tons per sq. in. Ultimate.	Sample casting strength. Average minimum,† tons per sq. in. Proof.	Sample casting strength. Average minimum,† tons per sq. in. Ultimate.	Sample casting strength. Average mean,‡ tons per sq. in. Proof.	Sample casting strength. Average mean,‡ tons per sq. in. Ultimate.
Aluminium alloys						
LM.6-3L33	3.0— 3.5	10.5—12.0	3.87	9.03	4.56	9.98
LM.23–133–RR.50	6.5— 7.5	10.0—12.0	6.72	9.93	7.41	10.83
LM.5–165–Birmabright	5.0— 5.5	9.0—11.0	5.89	7.90	6.30	9.90
LM.9–245–Alpax	13.0—14.0	15.5—17.0	12.30	15.20	13.40	16.10
LM.4–424	4.0— 4.5	9.0—10.0	5.04	8.62	6.24	10.21
LM.11–298	8.0— 9.5	14.0—16.0	5.37	13.95	7.73	14.90
LM.11–304	11.0—12.0	18.0—20.0	10.62	16.04	11.76	17.70
LM.10–300	9.5—10.5	18.0—21.0	8.95	12.20	11.28	16.21
Magnesium alloys						
L.122–289–A.8	4.0— 5.0	13.0—16.0	4.0	10.78	4.60	13.87
721–Z.5.Z	8.5—10.0	15.0—18.0	6.40	10.60	8.0	13.70

* Average of 17 sections from a magnesium casting, fettled weight 500 lb. All other data in this chart are from an unpublished Ministry of Supply report, and are reproduced by permission of the Controller, H.M. Stationery Office.
† Lowest average recorded from the same section of a number of castings obtained from one supplier.
‡ Average properties obtained, in each alloy, from castings supplied by all founders of that alloy.

TABLE 3.—*Comparative Values of the Casting shown in Fig. 1, made from Various Alloys, under a Particular Working Stress.*

Material.	Heat treatment.	Working stress, tons per sq. in.	Web depth, in.	Web thickness, in.	Machined weight, lb.	Relative value, estimated.
Aluminium alloys.						
Birmidal–LM.8–735	W.P.	12.0	2.3	0.31	1.8	80
LM.4–424	M	3.5	4.5	0.43	3.0	100
D.8– 424	W	5.0	3.5	0.40	2.3	85
"Y"–LM.14–2.L.35	W.P.	10.0	2.7	0.34	1.9	90
Birmidal–LM.8–722	P	7.0	3.0	0.37	2.1	90
Magnesium alloys						
Commercial C.121	M	3.5	4.3	0.43	1.9	90
C.122	W	4.0	4.0	0.43	1.7	85
C	W.P.	5.0	3.5	0.40	1.5	80
Z.5.Z 721	M	6.0	3.1	0.37	1.4	200
TZ.6	—	8.0	3.0	0.34	1.3	340

TABLE 4.—*Comparative Values of the Casting shown in Fig. 1, under the same Load as in Table 3, made in Various Alloys to give a Reduced Deflection*

	Modulus lb. per sq. in.	Web depth, in.	Web thickness, in.	Machined weight, lb.	Relative value. Casting.	Relative value. Machining.	Relative value. Total.
Aluminium LM4–424–W	10.5×10^6	5.0	0.50	3.3	100	30	130
Magnesium Commercial W	6.5×10^6	5.5	0.35	2.5	105	25	130
Cast iron	16.0×10^6	4.3	0.43	7.2	56	45	100

made as a casting in iron, aluminium, and magnesium, designed on Young's modulus to give a reduced deflection under the same load as that in Table 3. It is interesting to note, by comparing the respective dimensions of aluminium and magnesium in Table 4 with those in Table 3, how much bulkier and heavier the casting have to be when designed against deflection and not stress. Incidentally, the working stress used in Table 3 is based on minimum proportion to its temperature, and as it cools it contracts in all directions leaving space where previously there had been metal, and the area becomes porous unless it is filled by a further supply of metal. This further supply is provided by a reservoir of metal (known as a riser or feeder head) situated above the heavy section, on a flat surface of the casting or on the face of a boss, if it is conveniently positioned. Otherwise it may be

necessary to ensure adequate feeding by thickening the wall of the casting locally, or providing a web to give better access for the metal from the riser to flow to the boss.

The value and size of feeder heads will be appreciated when it is realized that to ensure soundness in some light-alloy castings the weight of heads may be as much as six times the weight of the casting they feed, although 2:1 is an average proportion.

Chilling

Quite often, the addition of a web is not permissible so the foundry has to resort to chilling the mass of metal by various means.

In sand castings, shell moulding, and the like, because heat is conducted more rapidly through metal than through sand, metal chills are made of sufficient thickness to conduct heat away from the local heavy portions so that, after insertion during the moulding operation, they produce a more uniform, and therefore more advantageous, rate of cooling of the molten metal in the mould.

In die casting, where the mould is all metal anyway, the thickness of the die may be increased in the heavy sectioned area, or alternatively, passages incorporated in the design of the die may be used for cooling or heating as required.

Flowing Design

Light alloys are poured at about half the temperature, and weigh about one-third as much as other ferrous and non-ferrous metals and, pressure moulding apart, it is only necessary to compare the sluggish flow of magnesium and aluminium through mould cavities with the rapid flow of ferrous alloys, to appreciate the need to encourage the passage of metals, again by flowing lines in design.

For instance, where possible, ribs and webs should radiate from, or join bosses and pads in preference to a junction at an adjacent wall but, where a boss is not available, it is better to make a junction as near right angles as possible to avoid the thickening of section between walls of an acute-angled junction.

For the same reason, fillet radii should not be more than half the thickness of the wall or rib, since any larger radius may cause excessive mass, leading to porosity, whilst a radius less than half wall thickness tends to create a concentration of stress at the junction, both being defects which defeat the object of the rib.

Bosses and Pads

In ferrous designs spot-faced bosses on bolted faces, intended primarily to reduce stress concentration, help to keep the weight of the casting down to a minimum, but in light-alloy designs, due to somewhat lower strengths and greater ductility, the bosses should be closer pitched and larger in diameter. In fact it may be advantageous to join all the bosses together to form one large pad which may then be used to provide a surface for the feeder head—if it is at the top of the mould, or, if the bosses were to have been on the side of the mould, the expense of loose pieces on the pattern, or perhaps the expense of a core, may be obviated. Even if the bosses are in a more inaccessible part of the mould, the expense of a number of semi-circular chills may be reduced to a few standard flat chills, or even eliminated altogether because of less frequent change of section.

A pad blending with the general contour of the casting may also give a smooth appearance, better than knobbly protrusions. The increase in weight is only slight since 1 cu. in. of magnesium weighs only 1 oz. Thus, taking the case of a pad joining two 1-in.-dia. bosses at 3-in. pitch standing proud of the casting wall by $\frac{1}{4}$ in., the increase in weight would be only $\frac{1}{4}$ oz., which is a small price to pay for possibly simplifying the pattern equipment, improving foundry technique, increasing production, and achieving a better distribution of stress.

Because of the free-cutting properties of light alloy, the time taken and the tool wear associated with milling a pad with a continuous cut, may even be less than that of the intermittent milling or spot-facing of individual bosses. The floor-to-floor time of milling $\frac{3}{16}$ in. from a pad 5 in. by 3 in. on a batch of magnesium castings should be less than 1 min. per casting, most of which time is taken in setting the casting into, and removing it from, the vice.

Lightening Holes

Castings with large surface areas are often designed with lightening holes for weight or economic considerations, but in the foundry they are sometimes a help and sometimes a nuisance.

If the hole is produced in the mould by part of the pattern then the only limit to its size is determined by design strength, always provided there is sufficient area for the feeder heads, should the holes be formed at the top of the mould.

However, if a core is required solely to produce the lightening hole, as for instance in the side walls of a mould, then it may be that for commercial prices, the cost of the core is greater than the value of the material saved, and the hole then becomes uneconomic. In these circumstances, to be economic a core should remove more than 4 cu. in. of magnesium and $2\frac{1}{2}$ cu. in. of aluminium which, on a wall $\frac{1}{4}$ in. thick, represents a minimum area of 16 sq. in., and 10 sq. in., respectively.

The lightening hole can be helpful to the foundry by providing, in existing cores, an outlet for gases to escape, and also by providing adequate support or access inside the casting for the removal of core sand and wires, and for examination and trimming of inside recesses.

Beading

Beading is sometimes required in highly stressed parts to avoid concentration of stresses around holes and along the edge of a cast shape, and to prevent buckling under compressive bending loads.

Beading on the outer faces of a casting, or at the extremity of a rib can be a nuisance to a foundry by causing a multiplicity of cores, and, on the top surface of the mould, by restricting the space available for risers and their subsequent cutting off and fettling.

Cast Inserts

Working surfaces of a casting subject to wear, or difficult to machine, can be produced in light-alloy castings by using inserts of a harder material, previously shaped as required, and cast integral so that the molten metal sets and contracts on to the insert, holding it firmly in position.

It must be realized that the two dissimilar metals do not bond together, except perhaps by the "Alfin Process,"[2] the strength of fixing being mechanical and determined by the profile of the insert. A good method of making inserts is by machining from round bar with a milled, transverse semicircular groove, or from hexagon bar with a similar groove turned during the parting-off operation. These methods are preferred to having a knurled surface, which is purely frictional and tends to trap air or dirt in the crevices.

Most metals, including aluminium or copper, may be used in either magnesium or aluminium provided the insert is of sufficient mass to chill the surrounding molten metal of the casting, otherwise the casting metal may melt or distort the insert. Ordinary mild steel or cast iron is often used to overcome this difficulty.

Tubes, with or without screwed ends, can be cast as inserts to provide passages through the casting for cooling, heating, or lubrication media, but, as with all inserts, it is advisable to consult the founder to ensure that they can be adequately supported in the mould.

Screw Threads

Until Fenn's comprehensive report[3], very little had been published regarding strength of screw threads in light alloy, and the author has carried out some supplementary work to obtain relative values for the various other methods of fastening.

TABLE 5.—*Strength and Cost of Magnesium-alloy Fastenings.*

Material .. .. .. Commercial magnesium cast in round-bar form.
Tensile load .. .. Average of tests to fracture bolt, insert, or magnesium (tons).
Cost of assembly .. Estimated on basis of batches of 100 bolts (shillings).
Depth of penetration .. In each case 1¼ diameters.

Thread form .. .. / Length of bolt	6 B.A. ⅜ in.	2 B.A. ½ in.	¼ in. Whit. ⅝ in.	⅜ in. Whit. 1 in.	½ in. Whit. 1 in.	⅝ in. Whit. 1¼ in.	¾ in. Whit. 1½ in.
Standard bolts							
Supply B.D.M.S. bolt	1.0	1.5	19.5	25.0	29.0	32.0	42.5
Drill, tap, and assemble	13.0	15.0	18.3	25.0	33.3	43.7	50.0
Total cost, shillings	14.0	16.5	37.8	50.0	62.3	75.7	92.5
Tensile load, tons	0.18	0.54	0.90	1.88	2.33	3.34	5.30
High-tensile bolts							
Supply chromium high-tensile-steel bolts ..	Not available		9.0	11.2	15.0	22.5	30.5
Drill, tap, and assemble			18.3	25.0	33.3	43.7	50.0
Total cost, shillings			27.3	36.2	48.3	66.2	80.5
Tensile load, tons			1.10	—	3.45	—	6.54
Wire thread inserts							
Supply insert and mild-steel bolt	49.0	61.5	84.5	100.0	114.0	144.0	192.5
Drill, tap, and assemble both	20.0	25.0	27.0	35.4	50.0	66.6	75.0
Total cost, shillings	69.0	86.5	111.5	135.4	164.0	210.6	267.5
Tensile load, tons	0.20	0.57	0.81	1.80	2.08	3.33	5.61
Drive inserts							
Supply insert and mild-steel screw ..	17.0	21.5	Not available				
Drill, drive, and assemble	13.0	14.0					
Total cost, shillings	30.0	35.5					
Tensile load, tons	0.17	0.30					
Self-tapping insert							
Supply insert and mild-steel bol	5.3	8.5	36.8	47.5	61.5	67.8	93.0
Drill and assemble both	13.0	15.0	18.3	25.0	33.0	43.7	50.0
Total cost, shillings	18.3	23.5	55.1	72.5	94.5	111.5	143.0
Tensile load, tons	—	—	0.61	1.77	2.30	—	—
Self-tapping screw	No. 4	No. 10	No. 14				
Supply screw	1.5	2.1	3.1				
Drill and assemble	8.7	10.8	14.0				
Total cost, shillings	10.2	12.9	17.1				
Tensile load, tons	0.34	0.50	1.25				
Drive screw							
Supply screw	1.3	2.5	3.4				
Drill and assemble	8.7	9.5	10.4				
Total cost, shillings	10.0	11.0	13.8				
Tensile load, tons	0.14	0.26	0.68				

Some data from these reports are given in Table 5, but in addition it should be noted that (1) Coarse threads—Whitworth and UNC—withstand 25 to 30 per cent. higher loads than fine threads: BSF, UNF, and BA; (2) very seldom within the range chosen is an insert stronger than the light-alloy thread of the casting, and (3) high-tensile steel bolts are necessary to shear the light-alloy thread of the casting beyond a depth of penetration equal to one diameter. However, as these results are from static tests only, it would be interesting to know the effect of vibration. Wire-thread inserts may possibly be

more flexible than the solid thread and thus resist vibration better.

Corrosion

Where steel is used as an insert cast into light alloy it is not necessary, as sometimes mistakenly occurs, to specify stainless-steel to avoid galvanic action between dissimilar metals, because it is unlikely that moisture or anything else will seep between the metals to act as an electrolyte and start corrosive action. Galvanic corrosion is more likely to occur at exposed junctions, not only of the cast inserts, but of nuts, bolts, and other fastenings, and this can be largely overcome by cadmium-plating the steel fittings.

A lot of attention has been given to the corrosion associated with light alloys, possibly due to the oxide colour being white, instead of the brown rust usually associated with ferrous metals. It is evident from examination of steel-faced magnesium moulding-boxes used in certain iron foundries, that the common ferrous metals have no better resistance to corrosion than has commercial magnesium, excepting that it is inadvisable to use magnesium alloys in close proximity to sea water, unless regular and complete examination of the component is possible. The general rule is that where steel would require surface protection by paint or varnish, so also would light alloy.

Design Conversion

The cast shape uses the minimum amount of material, whereas a fabrication becomes expensive when machined or flame cut to reduce weight beyond the standards of drawn, rolled, or extruded sections.

In components designed for rigidity—taking into consideration the specific gravity, proof, or yield strength, and square of the depth (subject to reasonable cast proportions)—the weight of light-alloy casting may be expected to be about 50 per cent. of the equivalent cast-iron casting or steel fabrication of the same strength.

In components designed to resist deflection—taking into consideration the specific gravity, modulus of elasticity, and cube of depth, again subject to reasonable cast proportions—the weight of the magnesium and aluminium castings may be expected to be about 40 and 50 per cent., respectively, of the ferrous equivalent to meet the same conditions, and this is illustrated in Table 4.

Even further reductions in weight may be made in the case of old designs which can stand improvement anyway, or where the founding properties, and not strength, have determined the wall thickness.

Conclusion

This paper was prompted in the first place by the questions asked by competent designers, who have had the wisdom to admit that technical colleges and textbooks do not give full instruction on all matters, and who have consulted the foundry before completing a design; and secondly, by the experiences of my former and present colleagues who try to make designers' pipe dreams materialize to production schedules and monthly accounts.

Acknowledgments

The author is indebted to his former and present colleagues for their information, advice, and co-operation during the preparation, and also to their directors for permission to submit this paper.

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[2] Dew, S. B., and Woodcock, R. W. 1950 *Mech. World*, 127, 665, "The Al-Fin Process."
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Packaging Problems Committee

To assist industry in its packaging problems, a new research and development committee has been formed by the National Federation of Box and Packing Case Manufacturers, St. Giles' House, 50, Poland Street, London, W.1. It has the objective of providing advice and information on all technical matters relating to the design and specification of timber and plywood cases and pallets. Both the Printing, Packaging and Allied Trades Research Association and the Timber Development Association are represented on the committee.

The former Association is concerned with carrying out research into such matters as journey hazards, properties of cushioning materials, etc., and with problems connected with mould and insect attack on packaging materials. It has an advisory service available to give information regarding machines, materials and sources of supply. The TDA is interested in research into the properties and treatment of hard soft, and plywoods, and can deal with queries as to the selection, use and supply of timber and plywood for cases and pallets of every kind. Founders who have problems in relation to safe transit of castings or finished goods (such as vitreous-enamelled ware) are invited to put them to the committee by writing to the address quoted above.

Report on German Industry

Birmingham Productivity Association has issued a special report incorporating the findings of a 25-man mission sent to Düsseldorf to examine German industry at first hand. The mission was led by Mr. Norman Hare, national treasurer of the Association of Engineering and Shipbuilding Draughtsmen. Among conclusions reached by the mission, is that the West German worker far from being the superman he is sometimes reported to be industrially, does not in fact match up to his counterpart in the British factory. It is suggested in the report that the reason for this may be that the German worker receives lower wages. The mission also found that the measures taken for the safety of workers, were inferior to those obtaining in the UK.

Other assessments made by the mission are that hours of work were 45 per five-day week for a 52-week year, overtime being unusual; holidays are taken by agreement thus avoiding the two-week shut down of industry which occurs in the UK; workshops were clean but not always tidy; and non-contributory pension schemes were being improved to attract labour. To build up a skilled labour force for the future all firms run a diploma apprenticeship scheme of professional standard. The report concludes "We felt that with a labour force which was more actively organized, greater productivity could be achieved."

Equipment and Supplies

Warning Device

A new warning device of the ionization-chamber type (Fig. 1) which gives a warning on receiving a gamma dose of 30 milli-Roentgens is now available in portable form from Radiotron, 7, Sheen Park, Richmond, Surrey; it is a battery-operated pocket-type unit weighing 12½ oz. It also responds to beta rays. Headphones may be plugged into the "Monitor" as the model is called. The instrument uses transistors and is also suitable for outdoor operation in temperate climates. The batteries have a capacity of 220 mAhr and as they are discharged only during the emission of the signal and no current is drawn during measurement, they provide for 2-3 months' operation under normal conditions. They are recharged *in situ* by means of a small mains-operated charger which weighs a few oz. and which can be plugged into the instrument.

The device has a flat response to radiation energies ranging from under 100 kv to 3 megavolts, an important point since in most cases the radiation is composed of various energies owing to Compton scatter.

FIG. 1.—*Portable warning device of the ionization chamber type.*

A useful supplement to the pen-type dosemeter which measures the cumulative dose received by the worker, it gives early warning of a rise in the dose rate which may be due either to the particular operating conditions or to an oversight.

Industrial Vacuum Cleaner

A new industrial vacuum-cleaner based on the "Clear-Flo" design is announced by Bivac Air Company, Limited, Beehive Works, Portwood, Stockport. The standard version of this new "CL" model is powered by a 5-h.p. motor, and a new and compact exhauster has been developed for the machine. The unit has been specifically designed for continuous heavy-duty operation. Wherever large quantities of dust accumulate, or toxic powders have to be handled, the filter incorporated prevents these harmful substances from recirculating, in an airborne state, through the workrooms. The filter will, it is claimed, successfully restrain powders with a particle size as low as 0.1 micron, and can thus deal with superfine materials such as carbon black and flue dust; a filter life of two years is guaranteed.

Fire Extinguisher

The introduction of a *leak-proof* 10-lb. carbon-dioxide fire-extinguisher, model 1510, is announced by Nu-Swift Limited, Elland, Yorkshire. The result of three years experiment, the new model supersedes model 1210 extinguisher of the same capacity. Mainly intended for fighting inflammable-liquid fires, and fires involving electrical equipment, indoors, the new extinguisher approved by the Fire Offices' Committee, has a 15-ft. range compared with only 8 ft. in the case of the old model. Additionally, by redesign of the nozzle, the fire-fighting capacity of the extinguisher has been doubled, the new model being capable, in the hands of an experienced fire fighter of putting out an 18 sq. ft. inflammable-liquid fire. Carbon dioxide, although much less efficient for fire fighting than dry powder, is non-damaging in use and leaves no residue, while the carbon dioxide can be made to penetrate into places otherwise inaccessible. Hence it is invaluable for fighting fires in laboratories, or fires involving fine chemicals or complicated electrical equipment.

Differential Pressure-gauge

George Kent, Limited, Luton, Bedfordshire, announce the addition, to their "Commander" range, of the Kent-Barton mercury-less diaphragm instrument for the measurement of differential pressures in six maximum ranges, up to 2,500 lb. per sq. in. working pressure.

This instrument, available as a circular-chart recorder, sector-scale indicator, or a circular-scale indicator, incorporates the "Barton" patented rupture-proof differential unit, which, although employing sensitive bellows for its actuating element, may be subjected to pressure differences equivalent to the pressure rating of the instrument without damage. To this range of instruments, there can be added, with certain limitations, additional elements for measuring pressure (Bourdon tube); temperature (mercury-in-steel); air-operated automatic control, and transmission of the primary variable.

Recording Hygrometer

To meet a need for some means of checking the humidity of dry gases, as for example in controlled-atmosphere annealing furnaces, a simple instrument now announced by Shaw Moisture Meters of 31 Market Street, Bradford, is stated to give immediate and continuous recording of the moisture present in even the most "dry" gases. It is claimed that the hygrometer gives full-scale deflection for readings of 5 per cent. R.H. or less, and also gives warning of any increase in humidity in less than one second. The sensing device is a small detecting element 1 cm. dia., and 6-cm. long, consisting of a capacitor with a hygroscopic dielectric only a few microns thick, covered with 24-carat gold. It can be used in industrial dryers at temperatures up to 150 deg. C.

GENERAL ELECTRIC COMPANY, LIMITED (Magnet House, Kingsway), have developed a radiation pyrometer for monitoring surface temperature in the induction-hardening process. The device may be used with a radiation-collecting probe, or with an aperture stop (or system of collimating stops) in the path of the incident radiation. It requires calibration in any particular application, but once calibrated, it lends itself readily to the following applications:—*with probe*:—Induction hardening of gear teeth, cams, etc.; induction melting; furnace-charge temperature measurement, and temperature measurement where the source is obscured by intervening structures, and (2) *without probe*:—measurement of die, and flame temperatures.

J. H. Sankey & Son, Limited (Essex Works, Ripple Road, Barking, Essex) have had independent laboratory examinations carried out on their Metaltop and Emerytop grades of industrial floor-surfacing compounds (see JOURNAL, September 25). Copies of the report are available to readers on request to Barking.

Steelfounders' Conference

Mr. C. H. Kain Mr. R. Lamb Mr. C. W. Briggs Dr. A. H. Sully

The illustration shows Mr. C. W. Briggs, technical and research director, the Steel Founders' Society of America, presenting his lecture at the steelmaking conference of the British Steel Castings Research Association, held this autumn. Of the others at the rostrum, Mr. C. H. Kain, who presided, is managing director of Lake & Elliot, Limited, and chairman of BSCRA; Mr. R. Lamb is a local director of Hadfields, Limited, and chairman of the BSCRA steelmaking committee, and Dr. A. H. Sully is director of research, BSCRA. Steelmaking and metallurgy provided the main theme of papers presented at the four technical sessions, summaries of the individual contributions being recorded in what follows:

At the fourth annual conference of the British Steel Castings Research Association (BSCRA), held at Harrogate last October, the chairman of the Council, Mr. C. H. Kain, of Lake & Elliot, Limited, welcomed a record number of 175 delegates representing all but five of the Association's member-firms. There was also present a number of eminent guests, including Mr. C. W. Briggs, technical and research director of the Steel Founders' Society of America, Mr. F. E. Ireland, the deputy chief Alkali Inspector; Dr. J. Keverian, of the General Electric Company, Schenectady, NY; Dr. V. Kondic, Birmingham University, and Mr. E. J. Vaughan, of the Royal Naval Scientific Service. In welcoming Mr. Briggs, Mr. Kain reminded the audience of the special arrangements for interchange of information which exists between BSCRA and the American Society, and which includes the annual exchange of lectures.

It is the Association's practice to arrange each of its conferences on a particular theme, and the subject chosen on the present occasion was steelmaking and metallurgy. In opening the conference, Mr. Kain remarked that four of the eight papers included in the programme had been prepared by members of the Association's staff, and presented results of research which had been undertaken since the occupation of the experimental foundry only 18 months previously. He added that the Association was to be complimented on having achieved so much in so short a time.

TECHNICAL CONTRIBUTIONS

The following provides a summary of the papers that were presented at four technical sessions under the chairmanship of Mr. E. W. Colbeck; Mr. Richard Lamb (Hadfields, Limited); Mr. P. M. Thomas (Wm. Beardmore & Company, Limited), and Mr. G. T. Harris (Wm. Jessop & Sons, Limited). The programme also included a lecture by Dr. A. H. Sully, the Association's director of research, the chair on this occasion being taken by Dr. E. Gregory (Edgar Allen & Company, Limited).

Comparison Between Cupola-converter and Electric-arc Steel

By H. J. Lloyd, B.Sc., and D. A. Driffill, A.Met., A.I.M. (Hadfields Limited)

In 1951, 37.0 per cent. of the steel made for castings was produced by the side-blown converter process, while 50.5 per cent. was from the electric-arc process; by 1957 these figures became 22.0 and 66.0 per cent. respectively. Despite this trend the authors showed that there are conditions and circumstances in which the side-blown converter has advantages as a steelmaking unit. This was made clear in the comparison which they made between the converter process, the acid electric-arc process, and the basic electric-arc process, in terms of cost, foundry layout, and production requirements. The comparison between the converter process and the basic -arc process was detailed in respect of the production of austenitic manganese-steel castings in the foundry to which the authors are attached. Interesting data were given in respect of temperature losses in austenitic manganese-steel in the two processes, from tapping to casting, and these speak in favour of the electric process.

Dealing with steel quality, the authors considered such factors as sulphur and phosphorus content, and the gas content (hydrogen and nitrogen) of carbon- and low-alloy steel, and of austenitic manganese-steel. The relative advantages and disadvantages of each process were summarized as shown in Table 1.

TABLE 1.—*Advantages and Disadvantages of Steelfoundry Melting Processes.*

(1) Acid-Electric-arc Furnace.

Advantages	*Disadvantages*
(*a*) High production rate.	(*a*) No removal of sulphur and phosphorus, therefore selected scrap is necessary.
(*b*) Low labour costs.	(*b*) Austenitic manganese-steel cannot be produced in it.
(*c*) The steel retains its fluidity for long periods and is easily "shanked."	

(2) Cupola/Converter.

Advantages	*Disadvantages*
(*a*) High production rate.	(*a*) Difficulty of control of temperature and composition of cupola metal.
(*b*) Short intervals between melts, therefore quick turnround of boxes in the foundry.	(*b*) High melting and blowing losses.
(*c*) Fluid steel which is easily shanked yet, if required, is provided in suitable amounts for "stopper-pouring" of small castings (e.g. 120 boxes in 30 min. from 50 cwt. of steel).	(*c*) Manganese losses when melting ferro-manganese for the production of manganese-steel.
(*d*) Austenitic manganese-steel can be produced by a duplex process.	(*d*) Dependence upon supplies of good-quality coke and scrap.
(*e*) Desulphurization can be achieved to a good degree.	(*e*) Increased sulphur pick-up when using high percentages of steel scrap in the charge.
	(*f*) Labour cost per ton of steel is high.

(3) Basic Electric-arc.

Advantages	*Disadvantages*
(*a*) Any steel specified can be produced.	(*a*) Slower production rate than with the other two processes.
(*b*) Scrap and turnings of inferior quality and composition can be used.	(*b*) Lack of flexibility with regard to amounts of molten steel produced.
(*c*) The steel has better mechanical properties than that made by the other processes.	
(*d*) The furnace can either be used for the production of ingots, when not required for the foundry, or can be shut down overnight without serious damage to the refractory lining.	

High-frequency Melting Furnace

By L. F. Keeley, A.I.M.
(Edgar Allen & Co. Limited)

The history of heating by induction was traced by the author back to the year 1927 when the method was first applied to the production of steel (the author omitted to mention that it was he who made that historical heat). The author described the construction of the high-frequency furnace, emphasizing the requirement for earth-leakage safety devices. The subject of refractories was dealt with and the author indicated the relative merits of silica, magnesia, magnesia/alumina and Chrome/magnesite as lining materials; lining, fritting-in and patching procedures were described, as well as the operation of the furnace. The author concluded with some pros and cons, the advantages being a good rate of melting and excellent temperature control, the inherent stirring action (which results in homogeneity particularly in alloying) and the facility with which highly alloyed steels can be melted to give maximum recovery of alloying elements. The disadvantages mentioned were the necessity for good-quality charge materials and the inability to carry out refining in the furnace.

Graphite-rod Resistor Furnace

By L. W. Sanders, A.I.M., and M. A. Totham, B.Sc., A.I.M. (Lake & Elliot Limited)

In this paper the authors described their experience with the 15-cwt. capacity furnace, rated at 350 kva. installed in the foundry of Lake & Elliot Limited, Braintree. The manufacture of carbon and alloy steel, by the two-slag basic process, and the practice for the making of stainless-steel from high-chromium scrap charges were detailed. It was shown that while the overall recovery of chromium in arc-furnace practice for 18/8 stainless-steel scrap charges was 88 per cent., that obtained in the resistor-rod furnace was 95 per cent. Graphical information in a series of frequency-distribution curves compared compositional and physical characteristics of steel made in the arc furnace and in the resistor-rod furnace, and indicated clearly that in respect of plain carbon steel consistently lower sulphur contents were obtained in the latter furnace. The yield stress, ultimate tensile stress, elongation, reduction of area and Izod impact value of steel made in the resistor-rod furnace were not only greater than those of steel made in the arc furnace, but they were distributed over a narrower range, the authors said. Similar results were shown in respect of 5 per cent. Cr/O.5 per cent. Mo steel. Simplicity of design, and the ease of maintenance were claimed as additional advantages for the rod furnace, whilst increased power consumption, refractory and carbon costs, were listed as disadvantages of the process relative to basic-arc-furnace practice.

Deoxidation and Degassing of Cast Steel

By Charles W. Briggs (technical and research director, Steel Founders' Society of America)

Part I. Deoxidation

The author indicated initially the principles of deoxidation, and cited the incidence of hot-tearing in relation to the presence of type-II inclusions. He stated that in the USA steel castings were being produced without the necessity of employing aluminium, zirconium, titanium or other strong deoxidizers, but that these castings were made under stringently controlled conditions of mould moisture-content, hydrogen-content, low pouring-temperatures, a minimum of metal transfer and short pouring-times. Because the control of these factors was not always possible, and fine-grain steels were desired (but mainly to prevent porosity), strong deoxidizers were in fact in more general use. The carbon/oxygen and hydrogen/oxygen relationships in respect of deoxidation and porosity were discussed. The design of a porosity test-casting was given, and the extent of porosity in such a casting for differing carbon and silicon contents, inclusion type and other pertinent factors showed that control of porosity often had an adverse effect on other properties. The subject of inclusion type was dealt with in detail and data were given which indicated

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that the properties attained with type-I were superior to those of steel containing the type-III inclusions of normal practice.

An evaluation of twelve deoxidizers in terms of their ability to suppress porosity and to convert type-II inclusions to type-I, and their effect on physical and mechanical properties was provided. The subject of "rock-candy" fracture and the effect of aluminium, Mischmetal, titanium and zirconium in various combinations in eliminating this type of defect were discussed, as was the use of Mischmetal and the effect of residual-sulphur content; at the same time, recommendations on the quantity of Mischmetal required as a function of sulphur content were made. The results obtained from the use of Mischmetal, tellurium, ferroselenium, the alkali metals, and commercially available complex deoxidizers, were given.

The ideal deoxidizer was stipulated as being one which (1) prevented pinhole-porosity; (2) formed type-I inclusions; (3) conferred high ductility and V-notch impact properties, and (4) prevented rock-candy fracture. On this basis, a complex deoxidizer consisting of aluminium, Mischmetal, zirconium and silicon had been produced and results obtained in field trials were given. These indicated that the use of this material might well be a ready answer to many of the problems associated with the making of steel for producing sound castings consistently.

Part II. Degassing of Cast Steel

The gas content (hydrogen and nitrogen) of cast carbon- and low-alloy steels made by different processes was quoted, and the reason for the low values obtained was attributed in the main to the generally adopted foundry steelmaking practice of employing a vigorous "boil." The effects of hydrogen and nitrogen on the ductility of cast steel were discussed, and the variation in properties across a 6-in. sand-cast section was attributed to variations in gas content—the residual gas of the centre of the section being approximately equal to that of the original liquid steel.

Apart from the employment of a vigorous boil, the other main contributing factors to high gas-content were stated as being the length of time the melted steel was inactive, and the moisture content of furnace and ladle refractories. The total hydrogen was stated as:

$$\begin{matrix} H_2 \text{ from} \\ \text{metal charge} \end{matrix} + \begin{matrix} H_2 \text{ absorbed} \\ \text{or lost in} \\ \text{melting} \\ H_2 \text{ absorbed} \\ \text{in tapping} \end{matrix} - \begin{matrix} H_2 \text{ eliminated} \\ \text{by the boil} \end{matrix} + \begin{matrix} H_2 \text{ absorbed} \\ \text{in furnace} \\ \text{finishing} \\ H_2 \text{ absorbed} \\ \text{in the mould} \end{matrix}$$

Various methods of lowering the gas content were discussed and it was stated that at present in the USA the use of vacuum-stream degassing was not practised because sufficiently-low gas-contents could be obtained in the section thicknesses normally required. The results of using argon, dry air and polytetrafluoroethylene (p.t.f.e.) were discussed, mainly in respect of alloy-steel casting practice. The requisite of producing a large number of small bubbles to effect physical reduction of hydrogen content was mentioned.

Finally the effect of hydrogen on the temporary loss of ductility and its recovery by ageing was discussed in respect of chill- and sand-cast steel blocks, and the differences in properties obtained from tests made on specimens taken from the centre, side, and corners, of these blocks were given in relation to the hydrogen content in these areas.

Oxygen Injection in Steelmaking Practice

By T. A. Cosh, B.Sc., A.R.C.S.T., F.I.M., and K. Knaggs, B.Met. (BSCRA)

The authors described the events leading up to the interest of the Association in oxygen-injection and the need for unification of practice as applied to the production of plain carbon and low-alloy steel for castings. After indicating the wide variations in oxygen consumption that had been observed in surveys made in steel foundries—the factors affecting the efficient use of oxygen and the shortcomings in the application of a somewhat "ideal" technique described in an earlier paper as the "cumulative potential"—were dealt with, and the points contributing to improvement in oxygen usage were discussed. The results obtained from melts made in members' foundries, in the carbon resistor-rod furnace and, in addition, those derived from previously published in the literature were given. These were shown in the form of a graph of initial carbon-content plotted against specific oxygen-consumption rates (*i.e.* the volume of oxygen required to remove 0.01 per cent. carbon from one ton of steel). These showed a wide degree of scatter which was reduced when the results were related to bath temperature prior to injection and when the specific oxygen consumption was related to that required for metalloid removal from the bath as denoted by the commencement of the "carbon flame." From consideration of these factors, two control charts were reproduced which indicated the volume of oxygen required to remove any desired quantity of carbon from a bath of steel of known carbon content at temperatures prior to injection of 1,500 and 1,600 deg. C. respectively.

Evolution, Control and Collection of Fumes from Steelmaking Furnaces

Part 1. Fume Evolution During Oxygen Injection

By K. Knaggs, B.Met.

The contributions from various workers towards the understanding of the mechanism of fume formation in various steelmaking processes was reviewed critically and mention was made of the findings in previously published papers of factors contributing to a mitigation of fume evolution. The author then described the experimental work carried out on this subject as related to the carbon-rod-resistor furnace in the BSCRA experimental foundry. He stated that in what was an essentially iron/carbon melt, for a fixed mean carbon level, the quantity

of fume increased with increased oxygen-injection rate; that for a fixed oxygen-injection rate the quantity of fume increased with increased carbon content; that in an iron/manganese/silicon/carbon melt the amount of fume collected after the carbon flame commenced (in a fixed sampling period) was 2½ times that collected prior to the commencement of the carbon flame, and that in a bath of similar composition but a lower carbon content considerably less fume was collected when no carbon was being removed. He concluded that the carbon removal reaction was a major contributing factor in fume generation. In a melt of low metalloid-content, little fume was created, the author said, but the quantity of fume formed increased with increased injection rates. When injecting air, the amount of fume generated was less than when the equivalent amount of pure oxygen was injected. The author then showed a ciné film which indicated that fume appeared to be formed above the metal surface in the bath by condensation from a vapour phase. He concluded by suggesting that although fume formation could not be attributed with certainty to any single mechanism, it was possible that the mode of occurrence was *via* a short-lived carbonyl reaction followed by a vapour-condensation action with localized high temperature playing a part, depending on the composition of the melt.

Part II. Control and Collection of Fumes

By C. M. Stoch, Dip.Ing., F.I.M. (BSCRA)

The author discussed atmospheric pollution and health as influenced by iron-oxide fume. He said that, while no maximum permissible concentration was officially recognized in the UK, the corresponding value in the USA was 42.8 mg. per 100 cub. ft. The highest concentration found in British foundries during a BSCRA survey for iron-oxide dust of respirable size (*i.e.* below 5μ) was 8.8 mg. per 100 cub. ft.

Methods of sampling fume and assessing the concentration were reviewed and the importance

(Continued overleaf)

BSCRA Steelmaking Course

BSCRA Steelmaking Course: *Following the success of refresher courses on moulding materials which the British Steel Castings Research Association has provided for its members during the past year, a new course has been started on the subject of steelmaking. It consists of a series of ten lectures covering such subjects as metallurgical chemistry, refractory materials, basic and acid electric-arc processes, furnace controls and instrumentation, deoxidation practice, gases in steel, and rapid methods of analysis. The course is held at the research laboratories of the Association and includes practical demonstrations in the chemical laboratory using the 6-cwt. capacity resistor-rod furnace installed there. The picture shows those attending the first of these courses: from left to right, Mr. L. Grieveson (Summerson's Foundries, Limited); Mr. J. McCaskie (Clyde Alloy Steel Company, Limited); Mr. P. A. Cooke (Richard Thomas & Baldwins, Limited); Mr. F. S. Wilson (English Steel Castings Corporation, Limited); Mr. T. A. Cosh (BSCRA); Mr.K. Knaggs (BSCRA); Mr. T. Smith (Glanmorfa, Limited); Mr. R. Townsend (Osborn Foundry & Engineering Company, Limited); Dr. J. L. Aston (Head, Wrightson & Company, Limited); Mr. O. Jones (Brown, Lenox & Company, Limited), and Mr. M. E. Moran (W. Shaw & Company, Limited).*

of isokinetic sampling in order to obtain true concentrations was stressed. The gas-sampling train developed by the British Iron & Steel Research Association was described as was also the simpler apparatus developed by BSCRA. Methods of dust and fume control from various steelmaking processes were described and, in the case of the electric-arc furnace, the merits of exhaust hoods fitted over and around the furnace were compared with the direct method of fume removal by a duct fitted in the side wall of the furnace. Under the heading of "Selection of Dust Collectors," the author compared electrostatic precipitators, the venturi scrubber and fabric and fibre filters, and emphasized that to minimize costs it was important to minimize the ingress of extraneous air into the system, thus implying that cooling by means of excess air was not necessarily the cheapest means.

Steelmaking Processes in Relation to Atmospheric Pollution

By R. J. Sarjant, O.B.E., D.Sc. (scientific advisor, BSCRA)

The overall picture of atmospheric pollution in the country and factors affecting it were considered in terms of changes in population, plant and equipment improvement, the number of working days per week, seasonal characteristics, the daily and diurnal habits of man and the influence of wind, temperature and rain. The effects of pollution on agriculture, horticulture, the health of cattle, the efficiency of power-carrying cables and the adverse effect of polluted rain were discussed, the Beaver Committee figure of an overall cost figure of £250 million per annum being quoted.

After stating the degree of atmospheric pollution in terms of combustible and ash (insoluble matter) and chlorides, sulphates and calcium (dissolved matter) for various types of localities, the author detailed the extent of the contribution from different steelmaking processes, in terms of particle size and amount of the emission. The actual emissions and deposits from iron and steel works in the UK and on the Continent for which data were available were compared, and in the examples given it was shown that the areas of intense deposition were much less for the UK works, mainly due to local geographical and climatic conditions. The dispersal of effluent from chimneys, the topographical and atmospheric conditions affecting dispersal, the Beaver Committee's recommendations for stack heights in relation to the height of surrounding buildings, and the effect of wind on "downwash" were discussed. The method of applying known and derived mathematical formulae and graphs to achieve optimum dispersion were described in sufficient detail to enable them to be readily applied. The author then discussed the effect of changes in the stability of the atmosphere and the conditions which resulted in abnormal dispersion of pollution.

Survey of the Metallurgical Properties of Cast Steel

By W. J. Jackson, M.Sc.(Eng.), A.R.I.C., A.I.M. (BSCRA)

This paper was a review of the Association's work in the field of metallurgy, mainly concerned with ferritic steels. Dealing first with micro-porosity, the author compared steel made by the vacuum-melting technique with that made by air melting in air, and showed that the differences in properties normally associated with micro-porosity were very slight. From this it had been inferred that gas evolution excited no great influence on the incidence of micro-porosity; and this had been substantiated by the application of a newly developed semi-microradiographic technique which had revealed the presence of narrow crack-like defects mainly in the equiaxial- or nuclear-crystal zones of a casting. It has been thought that the application of abnormal pressure during the critical stages of solidification may provide an effective means of control, and experiments using compressed-air applied to feeders have been commenced.

A short section of the paper described the earlier research of the Association into the causes of rock-candy fracture which spasmodically occurs. From this and other work it had been concluded that the precipitation of aluminium nitride at the grain boundaries was often responsible but recent work at Sheffield University had shown that hitherto undetected sulphide platelets can also be a cause of intergranular fracture. The Association is therefore financially supporting further investigations under the directions of Professor Quarrell at the University.

Association's Work

The Association's programme of work on the subject of heat-treatment has as its objective the determination of heat-treatment procedures that will give optimum ductility. Reference was made to the "one hour per inch of section" rule so commonly applied with or without divergencies, and the author indicated that the work already completed on carbon steels suggested that this rule would need modifications. It had also been demonstrated that double treatments on medium-carbon steels of 5-in. section did not confer any benefits. The work will later include studies on 1¼ per cent. Cr/Mo steels.

The fourth section of Mr. Jackson's paper described work on boron-treated steels, as distinct from the high boron (4 to 6 per cent.) steel used in atomic-energy applications. The composition, tensile, impact and magnetic properties of a series of low-carbon molybdenum/boron-containing steels were tabulated to show that reproducible high-tensile properties can be obtained from such steels in the normalized condition in flat sections up to 1½ in. thick. For steel castings where the tensile strength requirements were of the order of 40 to 45 tons per sq. in., combined with high yield strength, good tensile ductility, good weldability and fairly good magnetic permeability, the low-carbon molybdenum/boron steels were reported to have advantages over plain carbon-steel castings and some low-alloy steel castings.

The author then dealt with cast steels for low-temperature service and discussed the effect on properties at low temperature of steel composition, steelmaking practice, deoxidation practice and heat-treatment. Here, he remarked that in spite of the fact that increasing nickel content lowers the transition temperature, many designers specify a 3½ per cent. nickel steel for service temperatures down to −100 deg. C. For service below −100 deg. C. austenitic steels are normally specified, but the author indicated that a 9 per cent. nickel steel offered an excellent combination of properties down to −200 deg. C. after a double normalizing and tempering treatment. There are certain economic advantages attached to the use of such a steel and the Association's programme includes further work on this alloy. The steelmaking factors which contribute to optimum properties at low-temperature were listed and those properties of a series of experimental casts using different deoxidation practices on plain carbon steel were reported. The author emphasized the importance of heat-treatment and the relation of good low-temperature properties to features arising from production of the correct micro-structure, patricularly the attainment of a fine grain-size of ferrite and fine carbide dispersion. As-cast or annealed low-carbon steels, the author reported, were unsuitable for service at sub-zero temperature, but normalized or annealed-and-normalized low-carbon steels were suitable for temperatures down to −40 or −50 deg. C., he added. For alloy ferritic steels, a first requisite was the treatment to a martensitic structure followed by tempering; normalizing and tempering would not develop optimum low-temperature properties in these steels.

The final section of this paper provided a summary of the studies made of the effect of various constituents, heat-treatment and method of melting on the magnetic properties of carbon cast-steels. Data were tabulated on the effect of different heat-treatments of steels of various carbon contents. These showed that for annealed and normalized steels the remanence was at a similar level, but that of as-cast steel was at a lower value; in annealed steel, the coercive force was greater than that of normalized or as-cast steel, the increment being more marked with the higher carbon contents. Experiments on heat-treatment procedures with the objective of obtaining optimum magnetic properties showed that the highest permeability was obtained by slow cooling through the range 750 to 650 deg. C., followed by air cooling.

Studies on the effect of residual elements in steel indicated that copper was of little consequence but that combined amounts of chromium, molybdenum and nickel improved the properties. There appeared to be other factors, possibly gas content, which had an as-yet-unassessed effect. The harmful effect of manganese in quantities up to 0.93 per cent. on permeability were supported by experimental data. It was also shown that repeated remelting (in a high-frequency furnace) had a pronounced adverse effect, despite the fact that there appeared to be no substantial differences in composition and micro-structure. A substantial increase in oxygen content was suggested as a possible explanation of this significant fact.

New Customs Tariff

The new Customs and Excise Tariff, based on the internationally agreed classification known as the Brussels Nomenclature, was published on December 15, and will come into operation on January 1, 1959. Of the 22 member-countries of the Customs Co-operation Council at Brussels the United Kingdom will be the fourth to adopt the nomenclature: France, Germany and Austria already having introduced tariffs based on this classification. Other member countries of the Council will shortly be following suit and, in addition, a number of other countries throughout the world have changed or contemplate changing to Brussels pattern tariffs. As this process of standardization of tariffs proceeds international trade will be increasingly facilitated.

It is essential that importers and import agents should obtain copies of the new Tariff as soon as possible after publication in order that they may be able to enter their goods for Customs purposes in the correct manner on and after January 1, 1959.

The new Tariff will be in a blue binding and so will be easily distinguishable from the advance yellow-bound edition which was published in June, 1958, in order that importers and others might familiarize themselves with the new method of classification. The yellow-bound version should be discarded as the new version incorporates a considerable number of amendments and additions. The new Tariff may be purchased (price 12s. 6d. net) from any sales office of H.M. Stationery Office, York House, Kingsway, W.C.2, or through any bookseller.

Record Year for Thos. Firth & John Brown

Unless there is a major alteration in the present trend of business in the current financial year the profits, before taxation, are likely to be substantially less than those earned in the year to September 30, 1958, when a record turnover was achieved, state the directors of Thos. Firth & John Brown, Limited, steelmakers, of Sheffield.

Consolidated profits for the past year increased by £792,556 to £4,012,147, after depreciation, etc., and the dividend on the £7,700,000 ordinary is repeated at 10 per cent., with a 6 per cent. final. The 1956-57 interim was on £5,500,000—prior to a two-for-five rights issue. Throughout the greater part of the financial year the group operated the whole of the plant at full capacity.

During the latter part of that year and since September 30 there has been a considerable reduction in the value of orders received and, as a result, the production capacity of the group is not now being fully utilized and the position shows little sign of improvement.

HORSELEY BRIDGE & THOMAS PIGGOTT, LIMITED—Mr. B. Vincent Smith has been appointed a director.

ENGLISH ELECTRIC COMPANY, LIMITED—Dr. Philip Bowden has been elected a director and will devote part of his time to problems associated with the co-ordination of the group's research activities.

Retirement of Dr. J. G. Pearce, C.B.E.

Appreciation of his Services to the Foundry Industry (*1924 to 1958*)

Dr. J. G. Pearce, director of the British Cast Iron Research Association, retires from that position at the end of 1958. He has held office since 1924, that is, since the Association was but three years old. Dr. Pearce is internationally known and respected wherever ironfounding is practised; he is a graduate of Birmingham University and, among other distinctions,. holds an honorary doctorate (D. ING) from the University of Aachen, awarded in 1948. He received the O.B.E. in 1950 and the C.B.E. in 1957. He has been a member of the Worshipful Company of Founders since 1935, and the Livery recently conferred on him the Founders' Medal for services to the "art and mystery of ironfounding." His technical associations include membership of the Institution of Mechanical Engineers, the Institution of Electrical Engineers, Fellowship of the Institution of Metallurgists and of the Institute of Physics.

In his early years Dr. Pearce was associated with Sir Arthur Fleming in the planning and organization of the research and education department created by the Metropolitan-Vickers Electrical Company, Limited, in Manchester, and was co-author with Sir Arthur of two textbooks on apprentice training and research in industry. He has written and lectured widely both in Europe and the United States, and has served on numerous national and international committees; since 1935, he has been chairman of the main committee on cast iron of the British Standards Institution, and he is chairman of the appropriate committee on cast iron of the International Standards Organization.

Dr. Pearce's interest in education made him active in promoting the British Foundry School in 1935, an organization reconstituted in post-war years at Wolverhampton as the National Foundry College, of which, Dr. Pearce is vice-chairman of the Board of Governors. He is also president of the Foundry Technical Group—an association of the College's former students.

Scope of BCIRA Work

In the foundry world, the period 1924 to 1958 has been one of marked growth and change, not only in the Research Association, but also in the industry that it serves. In recent years, the output of iron castings has approached four million tons per annum, and the period has seen a steadily continuing improvement in technical control, quality, and strength of the material produced, which has been reflected in successive up-gradings in the minimum standard requirements for iron castings. This sort of general overall product improvement is perhaps more significant (if less spectacular) than the development of new cast irons, which possess impressive engineering properties, introduced during the same period, but both sorts of improvement are most certainly due in considerable measure to Dr. Pearce, his Council and staff Throughout the period, the ironfounding industry has shown its appreciation and awareness of this fact by its progressively increasing support. The Association, which in 1924 carried a staff of about 12 and had an income of the order of £5,000, now has 150 on its payroll and an income provided jointly from the industry and through the Department of Scientific and Industrial Research of about £200,000.

A dinner to mark his retirement was given to Dr. Pearce at the Connaught Rooms, London, W.C.2, last Monday, at which many old friends and representatives of the ironfounding industry were present. (An account of the dinner and presentation will be given in next week's JOURNAL.)

The portrait of Dr. Pearce reproduced above is taken from a review of his career which appeared in the JOURNAL's "Leaders of the Industry" series printed in the issue of February 4, 1954.

"In the Course of Employment" . . . . . Employers Liability for Negligence

By "Barrister-at-Law"

When is an employee acting in the course of his employment and when does he cease so to act? These are questions of considerable importance since they affect the question of the liability of employers for the negligence of their servants. If a person causes damage to another through some wrongful act, such as trespass or negligence, his employer cannot be held responsible unless the culprit was acting in the course of his employment. If the wrongful act was authorized by the employer, then clearly the employer would be just as liable as his servant. But the act, *although authorized* by the master, may be done in an *unauthorized manner* which is wrongful. In such a case the employer could not escape liability, even though he may have expressly prohibited the employee from conducting the particular operation in the wrongful manner in question. Thus, for instance, van drivers may be expressly instructed to observe speed limits and other requirements of the Road Traffic Acts. If, notwithstanding such warnings, a driver raced other vehicles and drove dangerously, and caused an accident, his employer would be liable.

The Material Factor

On the other hand, it is not enough that the negligence or wrongful act is committed at a time when the servant is engaged on the master's business. It must be committed in the course of that business. Thus, a van driver who is delivering castings of his employer may make a temporary deviation to give a friend a lift to a station or a hospital. During such time as he is giving the lift, he cannot be regarded as acting in the course of his employment; he is engaged in fact "on a frolic of his own" and on something solely for his interest. The employer therefore could not be held responsible for an accident which might occur during this period, through the driver's negligence.

One useful test—but by no means the only one—which is often adopted is whether the business in which the employee was acting at the time was business which equally concerned him and his employer. If so, then the employee must be regarded as acting in the course of his employment. Recent cases have raised the question whether a person can be regarded as still acting in the course of his employment, where, after working hours, he goes to collect his wages.

Collection of Wages

In Lowry *v.* Sheffield, etc., Company, Limited, which was decided in 1907, the employee had finished his work on Saturday morning, and was not due to resume work till the following Sunday night. After a substantial interval of time, he went back on the same Saturday to the pay office to collect his wages, as he was required to do if he wanted payment. While he was on the way, he sustained an accident on his employer's premises. The Court held that the employee was still acting in the course of his employment for the purpose of claiming workmen's compensation under the then Workmen's Compensation Act.

The basis of this decision, appears to have been that it was part of the contract of employment that the company should pay him his wages at the pay office and that he should go there to collect them. In the view of the Court, it was just as much part of his employment to go to the pay office on that day and at that hour, as it was for him to resume his work on the following Sunday night.

The principle of this case was further extended in 1911, by the case of Riley *v.* Wm. Holland and Sons, Limited. Whereas in the former case the employee's employment was still continuing, in the latter the employment had terminated. The employment ceased on a Wednesday, and the employee went back to collect her wages on the following Friday, *in accordance with the practice at the place of work*. It was held that she was still in the course of her employment (although it had been terminated) while she was on her employers' premises for the purpose of collecting her wages.

What is to be said, however, of the case where the employee is not on the employer's premises, though he is on his way to collect his wages at the appointed place and time? He might be, for instance, on his own premises or on the premises of some other person, or on the highway. Although this point does not appear to have been actually decided as yet, the general view appears to be that the employee is not to be regarded as being in the course of his employment in such circumstances, and that he does not begin to be in the course of his employment until he reaches his employer's premises.

Latest Decision

Two points raised by the two cases mentioned above arose again for consideration in the recent case of Staton *v.* National Coal Board, 1957, 1, W.L.R. 893. In this case an employee received fatal injuries as the result of the alleged negligence of a fellow employee, these acts being committed, it should be noted, on the premises of the employer. The question arose whether the fellow employee was at the time of the accident acting in the course of his employment, so as to render his employers liable for the accident. The circumstances were these. The fellow employee had completed his actual work in the morning and had gone home. In the afternoon, he returned to his employers' premises, and at the time of the accident he was proceeding from the time office, where he had obtained his time sheets, to the general office, to draw his wages. The employers required their employees to

"In the Course of Employment"

call at the general office at particular times of the week, of which this was one, to draw their wages.

The Court held that the fellow employee was engaged at the time on business which equally concerned him as well as his employers. For it was in the interest of both that the servant should draw his wages and that the employer should pay them, since otherwise no work could be done. It was partly the duty of the employee to go to the pay office to draw his money, and it was partly the business of the master who had to pay the wages and who found it convenient to pay them at those times and at that place. Accordingly the fellow employee was acting in the course of his employment, so as to render his employers liable for his negligence, if such negligence was established.

On Way for a Meal

In contrast to these cases, one may cite the case of Crook *v.* Derbyshire Stone, Limited, 1956, 1 W.L.R. 432. There a lorry driver had parked his lorry, and was crossing the street to get refreshment at a café, when he was involved in an accident with a motor cyclist. It was held that though the employers were aware of this practice, and although it was a perfectly proper one, yet as soon as the driver had parked his lorry to cross the road to get to the café he temporarily ceased to be acting in the course of his employment and was acting for his own purposes. Accordingly, his employers could not be held responsible to the motor cyclist for the consequences of his alleged negligence.

Sheffield University's New Library

Since 1909, Sheffield University has been using the library presented to it by the late Mr. Edgar Allen, of Edgar Allen & Company, Limited, but next year students will be using a new library which has been built at a cost of £550,000. Mr. T. S. Eliot, O.M., is to perform the opening ceremony on May 12, 1959. The new library forms a block on the north side of the main University site at Western Bank, and has capacity for about 1,000,000 volumes and accommodation for 400 readers; the periodicals room makes provision for 1,900 current journals.

When the library is opened a special degree congregation will be held, and among honorary degrees to be conferred are:—D.SC.—Sir Hans Krebs, Nobel Prizeman, formerly Professor of Biochemistry at Sheffield University and now Whitley Professor of Biochemistry at Oxford; Dr. R. Holroyd, deputy chairman, Imperial Chemical Industries, who graduated in Sheffield in 1924. D.ENG.—Sir Willis Jackson, director of research and education, Metropolitan-Vickers Electrical Company, Limited.

On June 27 next, at the annual degree congregations, among honorary degrees to be conferred are:—LL.D.—Sir Stuart Goodwin, chairman, Neepsend Steel and Tool Corporations, Limited, Sheffield; D.MET.—Mr. Harry Bull, managing director, Brown Bayley Steels, Limited, Sheffield; LL.M.—Mr. Joseph Madin, president of the Sheffield Trades and Labour Council; and M.SC.(TECH.)—Mr. Herbert Southern managing director, G. P. Wincotts, Limited, Sheffield.

British Aluminium and Alcoa

Now that shareholders in the British Aluminium Company, Limited, have received a letter from Lord Portal, chairman, on behalf of the board giving a full account of the negotiations which have taken place with the Aluminium Corporation of America and the offer made by Tube Investments, Limited, and Reynolds Metal Company (also of America) they are now in a position to arrive at a judgment on the rival plans. At a recent Press conference, Lord Portal said that it was not the board's present intention to call a meeting of shareholders.

The agreement with Alcoa, which was reached on November 14, provides that the American firm will buy the 4,500,000 unissued shares of British Aluminium at 60s. One-third—£4,500,000—of the sum involved is to be provided in the first place and the remainder at the board's request, but not later than December 31, 1961. Lord Portal said that if the contract went through, Alcoa had agreed not to use more than one third of the total voting power of the ordinary capital.

If Alcoa were to acquire a larger holding—for example, through the purchase of the 900,000 or so shares in British Aluminium now held by Tube Investments, it would not use the votes on these excess shares. The votes would be cast, but only in favour of the British Aluminium board.

Offers not Comparable

Contrasting the Alcoa proposals with the £35,000,000 TI-Reynolds Metals bid of shares and cash, Lord Portal stated in his letter: "I cannot too strongly emphasize the difference between the arrangements. The two plans are in no sense comparable. One is a business transaction designed to bring into being a partnership and introducing, as the first fruits of that partnership, large fresh funds to your company on favourable terms and in the flexible manner in which it would like to acquire them.

"The other is a take-over bid by third parties who have realized for some time that the gap between your company's present earning capacity and that which it will have when its potential earnings have materialized, might enable them to acquire a powerful empire for the price of a small kingdom."

The price of 60s. was the price of partnership. The price of 78s. was designed to persuade stockholders into parting with their stock so that the shareholders of Reynolds-TI might reap by far the greater part of the future benefit, Lord Portal insisted. He failed to understand why 33⅓ per cent. of British Aluminium shares in the hands of Alcoa would constitute foreign control and why 49 per cent. with Reynolds (obviously the dominant element in TI) was not foreign control.

If the Reynolds-TI bid was successful day-to-day control of the company would depend on directives received from the wholly-owning parent. "The function of the British Aluminium board would be to apply a rubber stamp to these directives."

Shareholders had not been consulted before concluding the agreement with Alcoa because he was convinced that that was the right course in the interest of stockholders. "It would have shown complete incompetence and lack of courage on my part if I had agreed to jeopardize this deal by the prospect of weeks of dangerous delay and the publicity pending the calling of a shareholders' meeting," he said.

[A direct offer to shareholders was made by Tube Investments and Reynolds Metals on December 15.]

American Letter

Grey-iron Decline Slows

The production rate for steel, the "bellwether" of the metal industry, renewed its upswing both in the US and Canada. Revival in demand by the US automobile industry and the settlement of protracted strikes in Canada has served to stimulate production. The fast rate of decline of grey-iron castings output is slowing down, and the trend may be reversing. Figures released by the Gray Iron Founders' Society show the following quarterly trend:

—	First quarter.	Second quarter.	Third quarter.	Fourth quarter.
1958 vs. 1957 ..	Per cent. −30*	Per cent. −24	Per cent. −11†	Per cent. + 6†

* For example, grey-iron production in the first quarter of 1958 was 30 per cent below that of the corresponding period in 1957.
† Estimated figures only.

Table 1 shows yearly delivery totals since 1946.

TABLE 1.—*Grey-iron Castings Deliveries* (*tons* × 1,000).

Year.	Total.	Year.	Total.	Year.	Total.
1946	9,200	1950	12,200	1954	10,300
1947	11,450	1951	13,400	1955	13,300
1948	11,800	1952	11,500	1956	12,400
1949	9,830	1953	12,200	1957	11,300

The reversal in declining output is illustrated in an analysis of the 1958 production (Table 2), which shows the reversed trend of cast-iron pipe production. Broken down into casting classifications, the "depression resisting" pipe production has shown an increase in output for the month of July, and this trend may indicate the future progress of other cast-iron foundry products.

TABLE 2.—*Analysis of* 1958 *Grey-iron Deliveries* (*tons* × 1,000).

—	All castings, total.	S.g. iron castings, total.	Heavy steel ingot moulds, total.	Pressure pipe and fittings, total.	Soil pipe and fittings, total.
Jan. to Aug. 1					
1957 ..	6,900	—	1,340	722	383
1958 ..	5,100	49	826	634	384
July only					
1957 ..	850	9.83	170	96.5	53.5
1958 ..	710	3.58	140	99.2	64.5
Change (per cent)	−17	−60	−18	+5	+20

Cast-iron Pipe for Sewers

The Milwaukee Metropolitan Sewerage Commission has stipulated that cast-iron sewer laterals be used in the city drainage system, beginning November, 1958. Use of vitrified clay, or bituminous fibre, lines will be ruled out entirely, and, where the commission does not specify size, the city ordinance will allow 4-in. cast-iron lines.

Raymond D. Leary, chief engineer for the city and metropolitan sewerage commissions, said the cast-iron laterals were proposed as the best means of eliminating the infiltration of ground and foundation water into the sanitary sewers. He said the commissions had learned that infiltration was occurring "at a tremendous rate," and something had to be done. Mr. Leary continued by saying that experience had shown that cast-iron sewer pipe, with oakum and hot lead in the joints, was most successful in reducing the infiltration.

The contract, worth £500,000, to supply the city with the 305,000 lineal ft. of cast-iron water pipe needed, has been awarded to the United States Pipe & Foundry Company, of Chicago.

Less Unemployment in America

The American labour force, increasing since 1952 at the rate of about 1 million a year, stands now at approximately 70 million. The business recession, which was well on its way in 1957, reached an unemployment peak in April, 1958, with over 5 million people out of work. However, in April the tide turned, and unemployment has since been steadily receding (see Table 1).

TABLE 1.—*American Employment Statistics.*

—	Unemployed (× 1,000).	Employed (× 1,000).
1950	5,000	59,000
1952	2,500	60,000
1953	2,500	61,000
1954	4,000	62,000
1955	3,800	63,000
1956	3,400	65,000
January, 1957	3,600	63,000
June, 1957	3,800	67,000
November, 1957 ..	4,800	64,000
January, 1958	4,800	63,000
April, 1958	5,200	63,000
June, 1958	4,900	64,000
September, 1958 ..	4,100	64,600
November, 1958 ..	3,800	65,300

Predictions for 1959 indicate a further decrease in unemployment, but not enough to restore "full employment." Note: Approximately 20 million out of the 60 million employed in the US are women, half of them married.

New Managing Director for S & L

Mr. L. M. T. Castle, a director and secretary of Stewarts and Lloyds, Limited, has resigned as secretary and has been appointed managing director, finance and general administration, with effect from January 1. Mr. J. R. Menzies-Wilson and Sir Frederick Scopes retire as managing directors on December 31, but will remain on the board. Mr. Menzies-Wilson will also remain chairman of Stewarts and Lloyds of South Africa, Limited, and Stewarts and Lloyds Minerals, Limited, and Sir Frederick Scopes will remain chairman of the Stanton Ironworks Company, Limited.

Mr. R. Otley, who has been with Stewarts and Lloyds since 1934, has been appointed secretary of the company as from January 1. From the same date, Mr. G. H. T. Macleod, deputy secretary, has resigned that appointment and has been appointed an assistant secretary and controller, general administration. Mr. T. W. Tomlinson has been appointed an assistant secretary.

The death is reported of Mr. R. C. ANDERSON who was joint managing director of Beckett & Anderson, Limited, mechanical and electrical engineers, Rutherglen, when he retired in 1949. He was with Mavor & Coulson, Limited, Glasgow, for many years before he and Mr. Frank Beckett founded their own business in Glasgow in 1910. Mr. Anderson retired when the business was acquired by the Coltness Iron Company, Limited, Newmains.

Personal

Sir STANLEY W. RAWSON has resigned as a director of Westland Aircraft, Limited.

Mr. W. E. REDFEARN has been appointed a director of English Steel Corporation, Limited, with effect from January 1 next.

The directors of G. & J. Weir, Limited, announce with regret the resignation of Mr. IAN G. CRAIG, head of their contracts division, and a member of the Cathcart executive board.

Mr. W. ROY BISHOP has resigned his position as sales manager and director of J. A. Prestwich Industries, Limited, and also his connection with the Villiers Engineering Company, Limited.

Mr. T. E. STEEL, chief accountant of Ransome & Marles Bearing Company, Limited, has been appointed secretary. He succeeds Mr. F. FREEMAN, who has relinquished his position for health reasons.

Dr. R. HUNTER has been appointed a director of the Steel Company of Scotland, Limited, and Mr. G. S. T. MARTIN a director of Smith & McLean, Limited. These companies are subsidiaries of Colvilles, Limited.

Mr. FRANK SOMERS has now formally retired from the board of Walter Somers, Limited, manufacturers of heavy steel forgings, etc., of Halesowen, near Birmingham, and Mr. F. J. Somers has succeeded him as chairman.

Mr. J. MAXWELL LAING, export sales manager of the Audley Engineering Company, Limited, Newport (Salop), is leaving in March to become managing director of a subsidiary company which is being established in Australia.

Mr. OLIVER HOWARTH has been appointed a director of Dennis Ferranti Meters, Limited, Bangor. Mr. Howarth started his career at Ferranti, Limited, Hollinwood, and before his retirement in 1954 he was chief engineer of the North Western Electricity Board.

Mr. J. P. V. WOOLLAM, Mr. R. B. POTTER, Mr. N. HINTON and Mr. P. D. TAYLOR, all executives of Simon-Carves, Limited, have been appointed to the board of its recently acquired subsidiary, Lodge-Cottrell, Limited. Mr. Woollam has been appointed chairman of Lodge-Cottrell.

After 47 years in the shipbuilding industry, Mr. ROBERT JOHNSON, assistant manager of the Manor Quay Works, Sunderland, of Joseph L. Thompson & Sons, Limited, has retired. He started his career with Sir James Laing & Sons, Limited, Sunderland, and joined Joseph L. Thompson & Sons in 1939 as head foreman plater.

Mr. W. FORBES RITCHIE, until recently chief engineer of the Consolidated Pneumatic Tool Company, Limited, at Fraserburgh, has been appointed manager of factory operations—a new position in which he will be responsible for the overall supervision and co-ordination of manufacturing operations in the company's centres at home and abroad.

Mr. GEOFFREY BARFORD, a director of the old Peterborough engineering firm of Barford & Perkins, Limited, and afterwards a director of Aveling-Barford, Limited, manufacturers of road machinery, earth-moving equipment, etc., of Grantham (Lincs), has been appointed president of Peterborough Agricultural Society. Mr. FRANK PERKINS, chairman and managing director of the Peterborough diesel engine manufacturers, F. Perkins, Limited, has been elected a vice-president of the society.

In recognition of 25 years' service with Victor Products (Wallsend), Limited, manufacturers of underground mining machinery, etc., of Wallsend-on-Tyne, Mr. JAMES CRAGGS was recently presented with a gold watch by the chairman, Mr. R. W. Mann, on behalf of the company. Mr. Craggs began work with the company at the age of 22, when it was trading as Charles Crofton & Company (Engineers), Limited. He served in the secretarial and accounts department for nine years and since then has been a contract engineer.

Mr. LEWIS CHAPMAN, chairman of W. Jessop & Sons, Limited, Brightside Works, Sheffield presented Mr. R. P. WALLACE, managing director of Jessop-Savilles steelworks, with an engraved watch in recognition of his long-service on December 6. He also presented illuminated long-service certificates to six employees who completed 40 years' service in July. They were Mr. W. BATTY, Mr. A. E. CRAWFORD, Mr. D. W. HAMMOND, Mr. J. NIXON, Mr. J. PLANT and Mr. G. POYSER. Mr. Hammond who was employed as a metallurgist in charge of the chemical laboratory, is now works manager and a local director. Mr. Wallace presented 33 employees with 25 years' service awards. The 34 men who complete 25 years this year—29 from the works and five from the staff—automatically became members of the Twenty-five Years' Service Association at the sixth annual dinner and social evening at the works canteen on December 6.

The Hadfields group of companies announces the appointment of three directors to the board of the parent company, Hadfields, Limited. The new directors are Mr. FRED COUSANS, Mr. GEORGE WOOD, and Mr. R. C. HEYS. Mr. Cousans joined Babcock & Wilcox, Limited, as a technical apprentice and then went to the Scunthorpe works of Thos. Firth & John Brown, Limited. He became works manager there before joining Catton & Company, Limited, Leeds, in a similar capacity in 1944. Three years later he went to Hadfields as foundry superintendent, and was appointed local director in the same year. He is president of the Sheffield branch of the Institute of British Foundrymen, and is an active member of the research committee of the British Steel Castings Research Association, and chairman of the Sheffield branch of the foundry production committee. Mr. Wood joined Hadfields in 1935 as research metallurgist, and 10 years later was promoted assistant research manager. He moved to the production side of the organization in 1949, and the following year was appointed heat-treatment superintendent. He became a local director in 1956 and also joined the board of the subsidiary, Hadfields Forgings, Limited. Mr. R. C. Heys is managing director of another company in the Hadfields group—Millspaugh, Limited.

Obituary

The death occurred on December 1 at the age of 78 of Mr. WILLIAM GREENWOOD, formerly an overseas representative of the National Gas & Oil Engine Company, Limited, Ashton-under-Lyne.

Sir JAMES MYERS, former principal of the Manchester College of Science and Technology, and then director of the Manchester University School of Education until his retirement three years ago, died on December 5 at the age of 68.

Law Cases

Operator Two-thirds to Blame

Damages of £500 for the loss of an eye as the result of an accident in a foundry were awarded to Mr. John Bruce by a jury sitting with Lord Migdale in the Edinburgh Court of Session. The plaintiff sued Henry Balfour & Company, Limited, gas and chemical engineers, ironfounders, etc., Leven (Fifeshire), for £2,500. The jury, however, assessed total damages at £1,500, but held that the plaintiff was two thirds to blame for the accident.

Mr. Bruce claimed that in 1955, while working as a sandblaster, he was told by the foreman to do iron-dressing on a casting and was given a hammer, a chisel, and a pair of goggles. He had never done iron-dressing before. He could not work with the goggles in position because the glass in them was rather dark, they were loose-fitting, and had steamed up. A particle of metal struck his left eye.

Denying liability, the company claimed that Mr. Bruce had been instructed in the work by the foreman, who had issued him with the goggles and warned him of the need to wear them.

Protest by English Steel

Upwards of £1,500,000 has been spent by the English Steel Corporation, Limited, Sheffield, on smoke-abatement equipment, but at Sheffield Magistrates' Court, the company was fined £20 for a breach of the Clean Air Act. The firm pleaded Guilty to allowing black smoke to be emitted from its heat-treatment boiler plant at Grimesthorpe for more than two minutes in a half-hour period.

Mr. Peter Jackson, for the firm, criticized the way in which the prosecution had arisen. He said English Steel had done everything in its power to avoid polluting the atmosphere. It had spent upwards of £1,500,000 on equipment for this purpose.

The reported incident had been an isolated one, but information was not laid nor a summons served until four months after the report. The firm, he said, had given all possible co-operation to the authorities over the Clean Air Act and expected "a little more in return than it had received."

Improvement in Machine-tool Industry

Orders from China for UK machine tools may mark the turning point in the fortunes of the industry. Reports from manufacturers suggest there was a small recovery in October, both from the home market and abroad and last month two substantial orders were placed for machine tools for China to the value of £1,100,000—one of the first effects of the relaxing of the trade embargo.

At present the market for the lighter machine tools remains poor, but there is more interest in the medium to heavy specialized machine tools and the lighter types being produced by some of the bigger manufacturers are being put into stock.

In September new orders from the home market fell to just over £3,000,000 and orders from overseas were cut to little more than £1,000,000. Since total deliveries to the home and export markets rose to £7,200,000 there was a further decline in the industry's total order-book to just under £60,000,000, less than three quarters of the total a year ago.

'TWAS THE NIGHT BEFORE CHRISTMAS, AND ALL THROUGH THE SHOP...

Not a casting was stirring; production had stopped.
Then suddenly there appeared in a fiery display,
Jolly old Santa, in his jet propelled sleigh.

He called to the foreman standing there in the murk,
" It's your own homemade mixes that foul up your work ! "
Then he reached in his bag, and said, " Here's the trick !
A real gift to die casters—that's famous DIE SLICK."

" Fumeless and odourless, it's sweeping the nation.
9 to 12 cycles with just one application.
Five different grades that will spray on real fast—
For zinc or aluminium, magnesium or brass ! "

" It cleans up the castings, won't discolour or mar .
Try it out Boys. There's no better by far ! "
So the boys sprayed it on, and with greatest of ease,
The castings came out just as slick as you please.

Try out a gallon—what can you lose?
No sticking, non-staining, so easy to use !
Don't wait for Santa—make your own test,
We'll cancel the invoice if DIE SLICK's not best.

With acknowledgements to G. W. Smith & Sons, Inc., Ohio

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the industry's standard die lubricant
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News in Brief

PARK FOUNDRY COMPANY (CHESTERFIELD), LIMITED, is planning to have a foundry workshop built at Park Road, Chesterfield, Derbys.

A LIST OF INDIAN FOUNDRIES has been prepared by the Board of Trade. It is published by the Export Branch, Lacon House, Theobalds Road, London, W.C.1, reference ESB/28866/58.

HALIFAX TOWN COUNCIL have approved a proposal that land belonging to the Education Committee at Beech Hill should be sold to Ada (Halifax), Limited, for an extension to their works.

HEPBURN CONVEYOR COMPANY, LIMITED, Wakefield, state that despite the trade depression, they have recently received orders in excess of £100,000 including one from Australia and three large units of Pangborn shot-blasting equipment.

At the Non-Ferrous Club luncheon at the Queen's Hotel, Birmingham, on December 10, the Marquess of Hertford spoke to members and guests about his home, Ragley Hall, and briefly outlined its history. At the meeting a collection was taken which realized £25 for the *Birmingham Post and Mail* Christmas-tree fund.

THE BUSINESS OF R. A. BRADSHAW & SON, LIMITED, ironfounders, Carr Foundry, Retford, which was established in 1867, has been taken over by W. J. Jenkins & Company, Limited, engineers, Beehive Works, Retford. The new owners state that the foundry business will continue with its present personnel.

THE ROYAL COMMERCIAL TRAVELLERS' SCHOOLS, 161, Uxbridge Road, Hatch End, Middlesex, have asked us to give publicity to the fact that in plain English they are hard up and need additional support from the 80,000 commercial travellers in this country. A special "appeal" leaflet has been prepared and is available to readers on writing to Hatch End.

THE DONCASTER FACTORY of International Harvester Company, Limited, has received an order from Egypt worth £200,000 for 100 tractors and other equipment, the largest secured by a British firm since the Suez crisis. The order is for the new Doncaster-designed and produced Farmall B-450 type. Since this model was announced early in November, 160 more workers have been taken on at the factory.

THE PRESIDENT OF THE BOARD OF TRADE announced in the House of Commons last week that the United Kingdom Government has accepted an invitation from the Ghana Government to send a trade and industrial mission to Ghana. The purpose of the mission will be to reaffirm the UK's interest in expanding trade with Ghana and to suggest ways in which British enterprise might assist development in Ghana. Sir George Binney has accepted the President's invitation to lead the mission.

THE ROVER COMPANY, LIMITED, has been awarded a £1,500,000 Australian Government contract to supply Land Rover vehicles and spares to the Australian Army through its subsidiary company in Australia. According to a company statement, "The securing of this valuable order has been greatly influenced by the far-sighted policy of the directors of the parent company who, in recent years, have instigated a policy of the development of manufacturing projects in important overseas territories."

THE BOARD OF TRADE announce that an agreement signed with the Government of the French Republic came into force on November 28 under which, on certain conditions, exemption is granted from payment of the French turnover tax on royalties to United Kingdom inventors (whether individuals or firms) who have licensed the use of their inventions in France. Copies of the text of the agreement are available on request from Mr. D. Mellor, Board of Trade, Room 4158, Horse Guards Avenue, London, S.W.1.

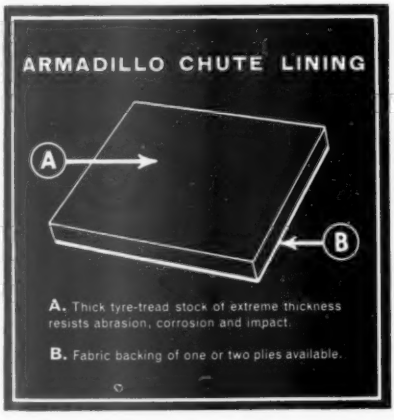
A PROPELLER, stated to be the largest ever built in Scotland, was recently transported seven miles through Glasgow in the early hours of the morning to Princes Dock. The propeller, made by Bull's Metal & Marine, Limited, Glasgow brassfounders, was moved on a 32-wheel trailer. It weighs 32 tons, is 23-ft. dia., has five blades and cost £16,000, and loading the bronze propeller on to a specially-constructed base took four hours. Its final destination is a shipyard in Sweden, where it is to be fitted to an American-owned tanker. The Glasgow firm is making two identical propellers for sister ships being built in the same yard in Sweden.

AT A CEREMONY to mark the opening of the foundry extension at the works of Spartan Steel and Alloys, Limited, Birmingham, on December 4, the Lord Mayor of Birmingham, Alderman Donald Johnston, released the first three tons of stainless steel into a ladle. The new foundry has been established at a cost of £150,000. The company states that its intention is to experiment in the wider fields of alloy production not so far exploited by Sheffield manufacturers of stainless steel. The Lord Mayor said that Birmingham industrialists would now have the opportunity of availing themselves of "home produced" steel ingots. (The foundry is to be described in this JOURNAL in the near future).

ALL PRODUCTION of the cooker-manufacturing firm of Aga Heat, Limited, is to be transferred from its factory at Smethwick to one at Ketley, near Wellington, Salop, at the end of the year. The Smethwick factory which has been occupied by the firm for more than 20 years, will be closed. The move is part of the policy of the Allied Ironfounders group of companies, to which Aga Heat belongs, to concentrate production in the interests of efficiency. A spokesman for the firm said that it was not yet known how many of the 140 employees, mostly engineers and foundrymen, at the Smethwick factory would be redundant as a result of the move. A number had been given the opportunity of transferring to Ketley, but it was possible that many would not accept the offer because the town was 30 miles away. There will be no loss in the continuity of production as Aga cookers are already being made at the Ketley factory.

SPEAKING on the subject of "Fuel Research in the Changing Scene," at the autumn meeting of the Manchester district section of the Institution of Gas Engineers, Dr. D. T. A. Townend, director of the British Coal Utilization Research Association, said that vast increases in world consumption of fuel for energy may well result in a global shortage of oil by 1970, or a little later. It would be foolish on the part of Britain, he said, to neglect research into the possible uses of coal. Although experts claimed that nuclear-energy costs would be rapidly reduced when it came into use, cost of generation would not make it competitive with coal or oil-fired boilers for 20 or 30 years ahead. The time would also come when new discoveries of oil would fail to keep pace with production. Present reserves were expected to last until the year 2,000, but some time in the future prices would rise. He concluded by saying that although an unpopular view, he felt that Britain should "hang on" to its coal, and every possible ounce of research should be put into making the best possible use of it

DEFEAT ABRASION


ARMADILLO CHUTE LINING
A
B
A. Thick tyre-tread stock of extreme thickness resists abrasion, corrosion and impact.
B. Fabric backing of one or two plies available.

with super-tough new ARMADILLO Chute Lining

HERE'S A LINING material that will even outlast heavy gauge steel, Goodyear Armadillo Chute Lining. Built from tough rubber compounds, which may be backed by fabric, it resists crushing, abrasion, acids, corrosion and heat. Its uses are limitless – it gives longer life to chutes handling abrasive materials, is used as lagging for driving drums, protects the insides of truck bodies, guards the walls of shot-blast chambers against wear. Available in a wide range of sheet sizes and thicknesses, it can be easily fabricated. Armadillo Chute Lining has important applications in *your* industry. Ask for details from The Goodyear Tyre & Rubber Company (G.B.) Limited, Industrial Rubber Products Department, Wolverhampton.

GOODYEAR

INDUSTRIAL RUBBER PRODUCTS

CONVEYOR BELTING • V-BELTS • TRANSMISSION BELTING • HOSE

Imports and Exports of Iron and Steel in October

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in October. Totals for the first ten months of this year and last are also included.

Total Exports of Iron and Steel

Destination.	Month ended Oct. 31.	Ten months ended October 31.	
	1958.	1957.	1958.
	Tons.	Tons.	Tons.
Channel Islands	331	2,901	3,795
Cyprus	220	9,645	5,105
Sierra Leone	325	11,948	10,497
Ghana	719	19,480	12,894
Nigeria	5,035	47,659	54,602
Union of South Africa	5,199	91,848	80,995
Rhodesia and Nyasaland	1,183	56,605	29,090
Tanganyika	2,172	19,026	12,090
Kenya	2,608	42,352	33,997
Uganda	221	3,066	2,705
Mauritius	179	2,571	2,775
Aden	171	3,893	2,537
Bahrein, Qatar, and Trucial States	585	13,442	7,481
Kuwait	1,607	30,637	35,176
India	19,269	195,175	121,346
Pakistan	2,085	58,236	47,848
Singapore	2,713	32,442	28,428
Malaya	1,468	27,208	12,910
Ceylon	3,071	22,563	23,476
British North Borneo	28	3,338	1,729
Hongkong	4,668	68,284	47,928
Australia	9,147	162,741	84,468
New Zealand	13,569	172,093	153,834
Canada	18,238	242,873	152,010
Jamaica	1,407	19,419	17,837
Trinidad	3,341	41,133	41,539
British Guiana	326	6,386	5,975
Other Commonwealth countries	4,567	23,745	34,358
Eire	3,082	36,932	40,910
Finland	2,609	70,294	41,191
Sweden	9,220	90,941	101,627
Norway	9,483	86,780	76,566
Denmark	5,031	87,239	71,406
Western Germany	8,277	8,526	44,239
Netherlands	6,019	81,467	67,377
Belgium	7,680	38,956	30,728
France	262	14,545	3,802
Switzerland	683	14,381	8,118
Portugal	831	14,990	11,818
Spain	1,965	33,328	38,037
Italy	1,423	42,845	42,374
Austria	351	4,501	8,495
Yugoslavia	40	9,514	3,441
Greece	612	9,527	11,279
Turkey	52	7,341	3,784
Netherlands Antilles	292	2,805	1,762
Portuguese East Africa	339	3,712	2,237
Egypt	64	6,121	11,793
Sudan	1,004	16,247	29,669
Lebanon	70	13,058	8,636
Israel	979	3,963	6,949
Saudi Arabia	21	4,026	3,670
Iraq	3,965	33,615	31,526
Iran	3,176	49,959	33,012
Burma	1,777	21,572	9,745
Thailand	751	6,743	5,937
Indonesia	120	6,024	1,773
Philippine Republic	79	5,818	2,999
USA	9,647	43,130	69,585
Cuba	920	7,517	5,238
Colombia	186	6,653	5,139
Venezuela	2,425	97,385	59,068
Ecuador	70	2,512	2,158
Peru	505	10,815	9,205
Uruguay	12	6,273	825
Argentina	4,046	87,799	112,257
Other foreign countries	16,747	117,802	127,732
TOTAL	209,276	2,636,365	2,213,532

Total Imports of Iron and Steel

From	Month ended Oct. 31.	Ten months ended October 31.	
	1958.	1957.	1958.
	Tons.	Tons.	Tons.
Rhodesia and Nyasaland	511	4,960	5,627
Canada	1,791	37,692	18,304
Other Commonwealth countries and Eire	1,121	19,994	19,768
Soviet Union	706	221,888	108,929
Sweden	1,981	27,456	29,779
Norway	4,337	98,692	60,954
Poland	—	7,383	173
Western Germany	1,489	86,496	62,916
Netherlands	12,390	56,767	119,354
Belgium	1,079	129,608	86,375
Luxembourg	139	22,101	5,811
France	550	57,385	16,751
Italy	1,442	3,576	6,795
Austria	3	59,061	3,746
Japan	219	13,363	2,996
USA	558	236,935	114,886
Other foreign countries	418	18,990	6,876
TOTAL	28,734	1,102,347	670,040
Iron and steel scrap and waste, fit only for the recovery of metal	1,348	600,902	62,390

Exports of Iron and Steel, by Products

Product.	Month ended Oct. 31.	Ten months ended October 31.	
	1958.	1957.	1958.
	Tons.	Tons.	Tons.
Pig-iron	17,186	106,462	120,743
Ferro-columbium (niobium)	2	80	31
Ferro-tungsten	88	482	629
Other ferro-alloys	402	2,711	2,991
Ingots blooms, billets, slabs, sheets, and tinplate bars	368	966	12,889
Iron bars, rods, angles, shapes, and sections	317	1,543	1,481
Steel bars, rods, angles, sections, and shapes	26,223	422,560	272,228
Iron plates and sheets	149	408	1,393
Universal plates	230	5,309	3,599
Steel plates, ⅛ in. and under ¼ in.	731	10,124	7,072
Ditto, ¼ in. and over	13,922	152,352	146,672
Blacksheets and blackplate	23,395	286,797	233,912
Hoop and strip	11,279	75,285	62,635
Tinplate	26,124	347,546	307,875
Decorated tinplate	1,011	4,286	3,564
Galvanized sheets	6,308	161,233	65,819
Other (incl. tinned sheets, ternesplate, and ternesheets)	1,234	15,889	11,434
Railway and tramway construction material	12,604	222,156	202,414
Wire rods of steel (incl. alloy steel)*	12,224	48,124	39,437
Wire	7,794	90,125	84,125
Tubes, pipes, and fittings	46,956	671,060	615,083
Iron castings	203	1,599	9,258
Steel castings	118	2,364	2,059
Forgings	408	6,904	6,189
TOTAL	209,276	2,636,365	2,213,532

* The figures for 1958 are not completely comparable with those for previous years.

Dr. A. J. KESTERTON, at present superintendent of steel production of the steel division, in the Steel Company of Wales, Limited, will be taking up the appointment of managing director of Davy British Oxygen, Limited, early in 1959.

AVELING-BARFORD, LIMITED, engineers, Grantham, have secured an order worth £130,000 from the Ministry of Supply, for 45 shuttle-dumper units for use by the Army. The machines have a six-ton capacity.

Electrical Aids in Industry *Data Sheet* **No. 5**

Resistance Heating – 2

Electric resistance heating elements have been briefly described in Data Sheet No. 4, with two examples (in furnaces and ovens) of their application in industry. This sheet lists some of the further applications which can be effectively dealt with by resistance heating.

Soft Metal Melting

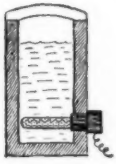
Electric resistance melting is most commonly used for lead, tin, zinc, antimony, aluminium and their alloys – in processes such as tinning, type-casting, die-casting and lining bearings — at temperatures of up to around 800°C.

In most cases, sheathed elements are immersed directly in the metal, a more efficient method than applying heat to the outside of the containing vessel or pot. Immersion heating simplifies the application of lagging to the outside of the vessel, reducing heat losses and current consumption to a minimum.

In all cases, the precise temperature control that is so essential in soft metal processes is readily achieved by the use of electricity, and electric heating also leads to a reduction of casting rejects and metal wastage and a marked improvement in working conditions.

Liquid Heating

Electricity provides an excellent way of heating liquids such as water, oils and varnishes; plating, photographic and other solutions, and of melting and heating waxes and compounds, glues and pastes, tars and bitumen. Again, immersion heating is the method most commonly employed.

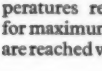


Fire hazards associated with inflammable liquids are invariably reduced by electric heating, particularly if immersion heaters are used.

It is usually possible without difficulty to apply electric heaters, either immersion or external, to existing vessels.

Platen, Press and Roll Heating

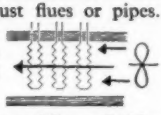
Electricity offers the simplest and most convenient method of heating platens, dies and rolls. It gives the precise temperature-control characteristic of electric heating systems, with lower maintenance costs. Moreover, the relatively high temperatures required in some processes for maximum working speeds are reached without difficulty.



When electric heating is used, one or more presses can be operated without the necessity of keeping a boilerhouse staff at work.

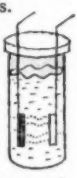
Air Heating

Streams of air, and of many other gases, can be heated most efficiently by electric resistance elements. Heat is generated only inside the duct, and none is carried away through exhaust flues or pipes. Quick rise of temperature and precise temperature control are thus assured.



Electric Steam Boilers and Steam Raising

There are many cases when the use of electricity for steam raising is fully justified on economic grounds.



The means employed for bringing steam from a boilerhouse to the point of usage are often extremely wasteful. The efficiency of the electric boiler normally exceeds 96% and is practically constant at all loads.

Plant requiring process steam can be equipped with its own electric steam boiler, freeing the working space of steam mains just as individual electric motor drives free the factory of masses of shafting and belt drives.

Even where boilerhouse steam is still used, it is sometimes desirable for best results to boost the steam temperature at the point of usage, to make up for transmission heat losses or to increase the superheat, and this function is most conveniently performed by an electric resistance heater inserted in the steam line.

For further information get in touch with your Electricity Board or write direct to the:
Electrical Development Association, 2 Savoy Hill, W.C.2. Tel: TEM 9434.

Excellent reference books on electricity and productivity (8/6 each, or 9/- post free) are available – "Resistance Heating" is an example; "Induction and Dielectric Heating" is another.

E.D.A. also have available on free loan a series of films on the industrial use of electricity. Ask for a catalogue.

CUT HERE

5858/4

Raw Material Markets

Iron and Steel

Trading conditions at the ironfoundries show little variation and there is not much prospect of any appreciable change in the near future. At the engineering and speciality foundries, most of which continue comparatively better employed than other sections of the industry, outputs of castings are maintained at reasonably good levels. Consumers of high-quality castings are taking up fairly substantial tonnages, but these are on a reduced scale compared with previous requirements.

Demands from the motor-car trade are maintained at recent levels, although usually at this period of the year production has tended to decline. The machine-tool industry shows no signs as yet of recovering former levels of business. The heavy engineering trade is taking up fewer quantities of castings, and other trades are in a similar position.

In the light-castings trade, the increasing demands for household equipment have resulted in a reduction in stocks. This in turn has brought an improved demand for castings, but generally, these foundries need a much increased flow of business to enable all of them to increase outputs, particularly for builders' castings which show little improvement in demand. The textile and many of the jobbing foundries are still short of work.

All grades of pig-iron are plentiful; the furnaces are carrying heavy stocks and outputs continue in excess of demands. Basic pig-iron is being taken up steadily by the steelworks but in much reduced quantities. Fairly substantial tonnages of low-phosphorus irons are being used by the engineering and speciality foundries and makers have no difficulty in fulfilling these demands. They are also taking up supplies of hematite and some refined irons, both of which are plentiful. The requirements of the foundries using high-phosphorus irons continue moderate. Generally, buying of all grades of pig-iron is on a hand-to-mouth basis, with little forward booking and the foundries are keeping stocks at a minimum.

The foundries are well provided with most grades of scrap, although there is a strong demand for the better and heavier grades of cast-iron scrap. Foundry coke deliveries are satisfactory and ganister, limestone, and firebricks are readily available.

The re-rolling mills generally are short of orders for most of their products, and production continues on a short-time basis. Even at this reduced rate of working, rolling programmes are difficult to arrange due to lack of tonnage. Reinforcing material is in fairly good demand, but for small bars and light sections business is very moderate. Export business is small due to the severe competition from makers abroad.

There is a surplus of steel semis and home steelworks could increase considerably on present deliveries.

Non-ferrous Metals

Non-ferrous metal markets are again firm. This is attributed to several diverse factors, including a more decided Wall Street, the growing belief that soft spots in the UK economy are now hardening—this is particularly applicable to the steel industry—and quiet confidence in the outlook for 1959.

In copper, these factors provide a favourable context into which has been poured the good news that UK stocks at the end of last week were slightly less than 6,000 tons (5,996 tons to be exact), continental buyers have re-entered the market, demand in the US has improved, and the US futures market is showing a stronger face than it has in recent weeks. Nevertheless, the overall position in Europe is that prices have edged higher due more to lack of any selling than to a high level of demand. As before, the LME prices are waiting a lead from America. In the US the stronger futures market and improvement in demand has, no doubt, played a strong part in preventing the custom smelter price from sinking to a general level of 28½ cents and the present position is that the split quotation of 28½-29 cents a pound is being maintained with producers holding on steadily to their level of 29 cents a pound.

Tin continues a good market both in London and in New York, with the UK price for cash now around £760 a ton. News that the International Tin Council is negotiating with Russia concerning her future selling policy for the metal has not affected the market, which is waiting to see the final outcome of these deliberations before taking a view. In America, the demand position seems reasonably steady and the price is fluctuating narrowly around $1.00 a pound.

Lead remains featureless with no news to stimulate buying or to harden existing sentiment. The recent strength of copper has helped in keeping the London price reasonably steady. In the United States the price is 13 cents a pound.

Zinc is somewhat erratic, although demand for spot supplies is good. The outlook for zinc seems reasonably assured on the assumption that US inventories of steel are said to be at their lowest for several years and a strong revival of demand is expected in the New Year—ahead of the American summer strike season. The US price is 11½ cents a pound. The US State Department has made it known that the US lead/zinc quotes would remain in force for at least a year.

Electrical Merger

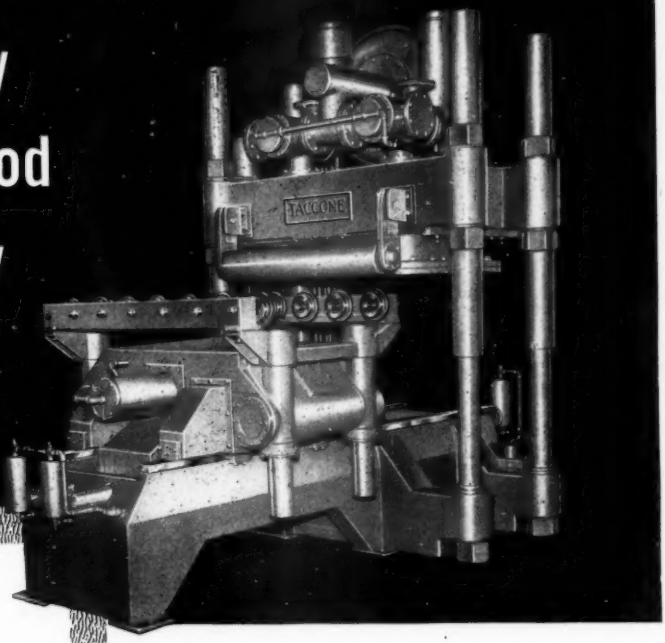
Further steps in the closer association of its two electrical subsidiaries, Brookhirst Switchgear, Limited, Chester, and the Igranic Electric Company, Limited, Bedford, are announced by Metal Industries, Limited. A new company, Brookhirst Igranic, Limited, has been formed, with Sir Charles Westlake, chairman of Metal Industries, as chairman. Other members of the board are Mr. John Black (deputy chairman), Mr. H. Owen Houchen (managing director), Mr. J. O. Knowles, and Mr. W. Padley.

Principal executives of the new company are:—Mr. G. H. M. Houston, director of sales and contracts; Mr. T. D. Turner, director of production; Mr. N. Clark, secretary; Mr. C. Payne, chief accountant; Mr. A. W. Page, sales manager, and Dr. J. N. Fletcher, leader of research. Mr. D. W. Kent will remain general manager of the Igranic Electric Company; general manager of Brookhirst Switchgear will be Mr. R. H. Mercer.

Closer association of the two companies, which employ half the Metal Industries group's 6,000 employees, was envisaged by Sir Charles Westlake in his statement to stockholders last July.

IT IS REPORTED from Montreal that the John Inglis Company, controlled by the English Electric Company, Limited, proposes to sell its refrigeration and air-condition division to J. & E. Hall, Limited, Dartford (Kent). The deal is subject to shareholders' approval.

An entirely NEW method of Foundry Moulding



with the

'TACCONE' HIGH PRESSURE DIAPHRAGM MOULDING MACHINE

The 'Taccone' machine makes precision green sand pressure moulding available to every foundry. It ensures sound, accurate castings and the moulds it produces are superior to those made by conventional equipment. 'Taccone' moulds are consistently hard and uniform throughout and can be effortlessly produced by unskilled labour.

All types of pattern equipment, including plaster, wooden, plastic and metal patterns can be used, and there is practically no limitation on the size of flask employed. 'Taccone' machines are handling flasks 8ft. by 8ft. (larger sizes are envisaged) and already over 200 'Taccone' installations are in operation.

The dimensional accuracy and finish on the castings is comparable with work produced by shell moulding techniques.

The 'Taccone' is more than a machine, more than a process—it is a revolutionary system for rapid mould production.

Ten standard machines are available in the manufacturing range and special machines can be built to any size for any purpose.

Please write for information

Baker Perkins Ltd.

Foundry Machinery Division
BEDEWELL WORKS · HEBBURN-ON-TYNE · CO. DURHAM
Telephone: JARROW 897124 BP/F1

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

December 15, 1958

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2: Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £23 17s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £24 1s. 3d.

Scotch Iron.—No. 3 foundry, £25 3s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 19s. 0d.; South Zone, £26 1s. 6d.

Refined Malleable.—P, 0.10 per cent. max.: North Zone, £27 6s. 6d.; South Zone, £27 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.: N.-E. of England (local iron), £25 6s. 6d.; Scotland (Scotch iron), Zone S.1, £25 13s. 0d.; Sheffield, £26 15s. 0d.; Birmingham, £27 4s. 0d.; Wales (Welsh iron), £25 6s. 6d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leics.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £41 0s. 0d. to £43 10s. 0d., scale 15s. 0d. per unit; 75 per cent. Si, £57 10s. 0d. to £60 10s. 0d., scale 16s. 0d. per unit.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 8s. 6d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 11s. 6d. per lb. of W.

Ferro-chrome (6-ton lots and over).—4/6 per cent. C, £83 10s. 0d. to £87 0s. 0d., basis 60 per cent. Cr, scale 30s. 0d. to 30s. 6d., per unit; over 6 per cent. C, £79 10s. 0d. to £85 0s. 0d., basis 60 per cent. Cr, scale 30s. 6d. per unit; 2 per cent. C,* 1s. 7d. to 1s. 10d. per lb. Cr; 1 per cent. C,* 1s. 7½d. to 1s. 10½d. per lb. Cr; 0.15 per cent. C,* 1s. 8½d. to 1s. 11½d. per lb. Cr; 0.10 per cent. C* 1s. 8½d. to 1s. 11½d. per lb. Cr; 0.06 per cent. C,* 1s. 9d. to 2s. 0d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £265 0s. 0d.; 96/98 per cent., £295 0s. 0d.

Ferro-columbium.—65/72 per cent., Nb + Ta, 19s. 9d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £73 0s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t., £32 15s. 6d.; tested, 0.08 to 0.33 per cent. C, £33 15s. 6d.; hard (0.41 to 0.60 per cent. C), £34 17s. 0d.; silico-manganese, £43 16s. 6d.; free-cutting, £36 14s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £41 1s. 0d.; silico-manganese, £44 4s. 0d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.33 per cent. C, £38 10s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 12s. 6d.; acid, up to 0.25 per cent. C, £43 4s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £42 2s. 0d.; boiler plates (N.-E. Coast), £44 12s. 0d.; floor plates (N.-E. Coast), £43 11s. 0d.; angles (N.-E. Coast), £39 16s. 6d.; joists (N.-E. Coast), £39 12s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £40 0s. 6d.; under 10 tons to 4 tons, £40 18s. 0d.; under 4 tons to 2 tons, £41 3s. 0d.; hoop and strip, coils, £39 0s. 0d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £44 16s. 0d.; black sheets (hand mill), 24g., £58 14s. 6d.; galvanized corrugated sheets, 24g., £67 10s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £68 10s. 0d.; nickel-chrome, £99 11s. 0d.; nickel-chrome-molybdenum, £111 19s. 0d.

NON-FERROUS METALS

Copper.—Cash, £218 5s. 0d. to £218 10s. 0d.; three months, £218 0s. 0d. to £218 5s. 0d.; settlement, £218 10s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 2s. 1½d. per lb.; rods, 237s. 0d. per cwt. basis; 20 s.w.g., 272s. 0d. per cwt.

Tin.—Cash, £760 0s. 0d. to £761 0s. 0d.; three months, £760 0s. 0d. to £761 0s. 0d.; settlement, £761 0s. 0d.

Lead (Refined Pig).—First half December, £71 5s. 0d. to £71 7s. 6d.; first half March, £71 5s. 0d. to £71 10s. 0d.

Zinc.—First half December, £75 0s. 0d. to £75 5s. 0d.; first half March, £71 0s. 0d. to £71 5s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £109 5s. 0d.; rolled zinc (boiler plates), all English destinations, £107 0s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £94 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 8½d. per lb.; sheets to 10 w.g., 186s. 6d. per cwt.; wire, 2s. 6½d.; rolled metal, 186s. 6d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £142; B6 (85/15), —; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £181; HTB2 (38 tons), £200; HTB3 (48 tons), —.

Gunmetal.—BS1400, LG2 (85/5/5/5), £178; LG3 (86/7/5/2), £188; G1 (88/10/2/½), £249; (88/10/2/1), £240.

Phosphor Bronze.—BS1400, PB1 (AID released), £269 per ton.

Leaded Phosphor Bronze.—BS1400, LPB1 (1060), £203 per ton.

Phosphor Bronze Strip, etc.—Strip, 273s. 0d. per cwt.; wire, 3s. 11½d. per lb.; rods, 3s. 2¾d.; tubes, 3s. 2¾d.; chill cast bars: solids 3s. 2¼d.; cored 3s. 2¼d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 8¾d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 1½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 0½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £74 0s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £180 0s. 0d.; aluminium bronze (BS1400), AB1, £221; AB2, £238.

* Average 68-70 per cent.

Company News

INDIAN IRON & STEEL COMPANY, LIMITED—The company announces that the Government of India has consented to the proposed issue of fully paid ordinary shares. The issue will be made on the basis of one share for every five existing ordinary shares by capitalization of share premium account.

MIDLAND ALUMINIUM, LIMITED—Turnover and profits of the group were better than last year and the board expected a good year's trading in spite of the fact that the seasonal slackening up has this year occurred somewhat earlier than usual, said Major C. R. Dibben, the chairman, at the annual meeting in Birmingham on December 4.

WM. E. DUNN, LIMITED, iron and steel scrap merchants and aluminium smelters, of Wolverhampton—As forecast when the company was made public last May, a dividend of 12½ per cent. on the £150,000 capital is being paid for the year to September 30, 1958. Group profit, after all charges, including taxation of £89,185 (£37,057), is £70,672 (£48,447).

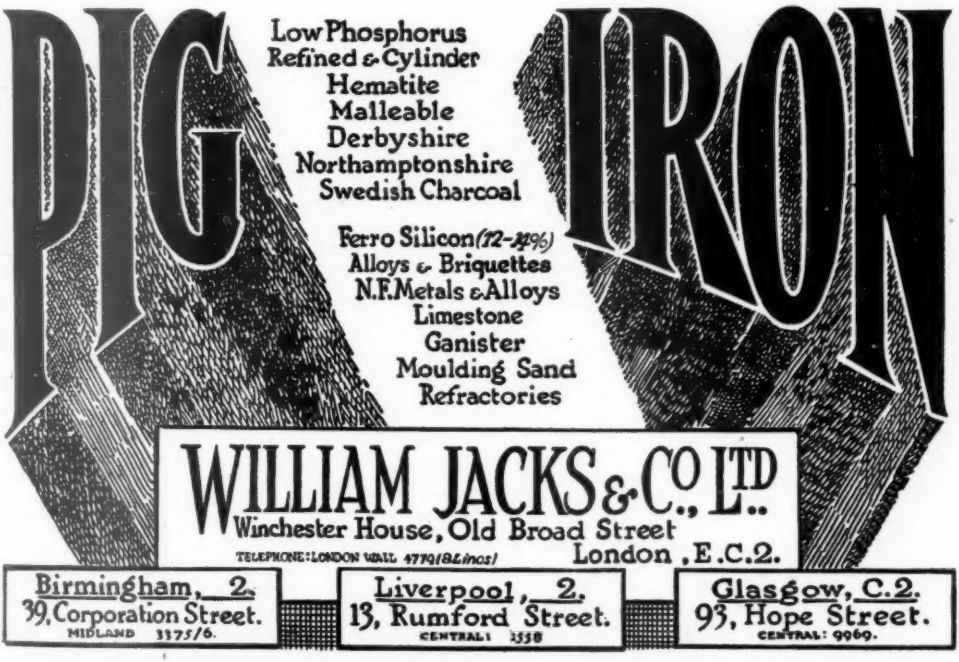
For the second year running the South Durham Steel & Iron Company, Limited, is raising its dividend by 2 per cent., making a final distribution of 8 (6) per cent. to give 12 (10) per cent. for the year ended September 27, 1958. Trading profit rose from £5,117,815 to £7,092,696. After depreciation and tax, net profit is returned at £2,893,117, which compares with £2,560,360 in the previous year.

PULSOMETER ENGINEERING COMPANY, LIMITED—The company has now completed the acquisition of the issued share capital of B.A.L., Limited. The purchase consideration is 165,260 ordinary shares of 5s. in Pulsometer Engineering and £250,000 cash. It has not been found possible to agree on final terms for the aquisition of J. Caslake, Limited, and it has been decided not to proceed at present with the issue of the debenture stock as previously announced.

BRIGHTSIDE ENGINEERING HOLDINGS, LIMITED—The company is paying a 6¼ per cent. final dividend, making 31¼ per cent. for the 15 months ended September 30, 1958. This is equivalent to the previous year's dividend of 25 per cent. A jubilee bonus of 10 per cent. is also being paid. The directors propose a 100 per cent. scrip issue. Present issued ordinary capital is £800,000. Group net profit for the 15 months was £563,321 (£371,574).

COVENTRY GAUGE & TOOL COMPANY, LIMITED—Net profit for the year ended August 31 is £160,041, after tax of £167,587. This compares with £134,364 for the previous year, when the tax charge was £207,108. The dividend is maintained at 6¼ per cent. The ordinary shares issued in exchange for the shares of Rockwell Engineers, Limited, now wholly owned by Coventry Gauge & Tool, do not rank for this dividend. The net profit of Rockwell Engineers for the year ended July 31, returned at £159,363, forms part of the pre-acquisition profits.

A PROVISIONAL CONTRACT to acquire the £100,000 issued share capital of the Chaseside Engineering Company, Limited, Hertford, and the $24,000 issue of share capital of an associated company, Chaseside Engineering Company (Canada), Limited, has been entered into by British Northrop, Limited, automatic loom makers, of Blackburn.



CLASSIFIED ADVERTISEMENTS

PREPAID RATES: Fifteen words for 7/6 (minimum charge) and 4d. per word thereafter. Box Numbers 2/6 extra (including postage of replies). Situations wanted 2d. per word throughout.

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, John Adam House 17/19, John Adam Street, Adelphi, London, W.C.2. If received by first post Monday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

FOUNDRY TECHNOLOGIST, 29, desires position. At present resident in Glasgow. Intermediate and Final City and Guilds Certificates in Foundry Practice. Sound foundry metallurgical experience including CO_2 Process, Shell Moulding, General Sand Control, supervising Cupola Melting, H.F. Melting and Crucible Melting. Car owner. Box FT366, FOUNDRY TRADE JOURNAL.

PRACTICAL NON-FERROUS FOUNDRYMAN, experienced green sand, dry sand moulding and most metals, extensive experience in CO_2, both production and experimental, desires change with prospects of promotion. Box PN364, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER / FOREMAN requires position immediately West Midlands Foundry. Grey, malleable, non-ferrous, life experience trade. Age 48. M.I.B.F., fully practical, excellent technician; sales, commercial experience. Accept full responsibility, disciplinarian, thoroughly reliable, conscientious. Security, permanency, reasonable salary. Box FM370, FOUNDRY TRADE JOURNAL.

HOT BRASS Pressings. London Agent is terminating agreement and offers a live and substantial connection to progressive firm with capacity available. Box HB373, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

FOUNDRY SUPERVISOR required to take charge of Ingot Foundry in the Birmingham area. Good opportunity for a man having experience in all aspects of Gunmetal and Brass Ingot production. Write, giving full particulars of experience and salary required, to Box FS362, FOUNDRY TRADE JOURNAL.

WANTED. EXPERIENCED ENGINEER or FOUNDRY FOREMAN having to his credit the practical experience of making CAST IRON SPUN PIPES on Centrifugal Machine. Preference will be given to persons who had worked on such Centrifugal Spinning Machines in works like "STANTON." Apply stating the pay and other facilities they would like to have. PIPE AND GENERAL CASTING CO. LTD., D/12, SITE, KARACHI. Pakistan.

A.P.V.-PARAMOUNT of Manor Royal, Crawley, Sussex, require two additional ASSISTANT MELTING SHOP MANAGERS for their Steel Foundries producing castings in carbon and alloy steels including a high proportion of stainless and other special high alloy compositions. Experience on H.F. Induction Plant essential, on Arc plant an advantage. Excellent working and living conditions in South of England, together with opportunity for applicants with executive and technical ability. Applications, in writing, stating age, experience and salary required, to the PERSONNEL OFFICER.

METALLURGIST required to operate new control laboratory for iron foundry in Nottingham. The post offers exceptional opportunities for an enthusiastic man, since the laboratory also serves a small group of companies engaged in a variety of fabrication processes. Applicants should possess a minimum qualification of L.I.M., or H.N.C. in Metallurgy, and should be free of National Service commitments. Experience in welding would be an additional advantage though this is not considered essential. Superannuation scheme in operation. Salary £700 upwards according to age and experience.—Please apply Box MR359, FOUNDRY TRADE JOURNAL.

WATERFORD IRONFOUNDERS LTD.
WATERFORD, IRELAND

require a Technical Foundry Works Manager for their fully mechanised, grey iron, light castings, production foundry melting 5,000 tons per year for cooker, stove and other castings.

Applicants should have received a general metallurgical training and preferably should possess a university qualification. The Manager appointed will be personally responsible for the technical direction of the foundry and for quality control, and must be fully competent to supervise sand and melting plants. An interest in new development work, particularly in the shell moulding field, is desirable.

The Manager will carry an overall responsibility for personnel management and production control, including work study, but much assistance is available in these departments.

The appointment should be of particular interest to a young foundry technologist willing to accept responsibility and having a progressive outlook.

Full details of age, general education, technical qualifications, positions held to date and salaries earned are requested in first letter.

Applications, marked '**Private and Confidential**' are guaranteed complete confidence and should be addressed to the **Managing Director, Waterford Ironfounders Ltd., Waterford.**

FOUNDRY FOREMAN required for mainly Ferrous work, in medium sized Foundry. Contributory Pension Scheme. Reply in writing, stating age, experience and salary required, to: PERSONNEL MANAGER, Laurence, Scott & Electromotors, Ltd., Gothic Works, Norwich.

PATTERN SHOP FOREMAN required for Steel Foundry in the North East. Must be fully experienced in jobbing work up to 2½ tons and machine moulded work. Applicant to be experienced in administrative work and able to organise a Pattern Shop to work to the Method Department's specifications. This is an important staff position, carrying a good salary. Pension scheme. Five-day week. Write Box PS365, FOUNDRY TRADE JOURNAL.

PRESSURE DIECASTING FOREMAN wanted for large Aluminium Foundry, West Bromwich district. Experienced man conversant with all types of Pressure Machines, able to control labour. Apply, stating age and experience, to PERSONNEL MANAGER, William Mills, Limited, Friar Park Road, Wednesbury.

EMIGRATION OPPORTUNITY
ADELAIDE, SOUTH AUSTRALIA

LARGE, well established and expanding Wholesale Merchants in Adelaide, have vacancy with excellent prospects for a man experienced in:—

FOUNDRY SUPPLIES AND MOULDERS' REQUISITES

Good experience, wholesale or retail, in buying, selling, and in the general handling of Foundry fluxes, Founders' metals, Crucibles and Assayers' materials, etc., is essential. Nominated passages for applicant and family, accommodation provided initially, pension scheme, etc. Apply in writing, quoting reference "FOUNDRY," and giving age, marital status, and details of training and experience and with COPIES of testimonials, if any, to the Agents, DAVIS & SOPER, LTD., 52 & 54, St. Mary Axe, London, E.C.3.

BUSINESS FOR SALE

NON-FERROUS FOUNDRY as going concern, East London. Freehold. Approx. floor area, 8,500 sq. ft. Whole area approx. 2,250 sq. yd. Well equipped, capable 15 to 20 tons per month. Principals only. Box NF367, FOUNDRY TRADE JOURNAL.

MACHINERY WANTED

PIN LIFT MOULDING MACHINES, preferably B.M.M. H.P.L. 2 or 3, or equivalent. LAWFORD PLANT AND MACHINERY, LTD., Manningtree 365.

WANTED—SPENCER and HALSTEAD "Centriblast" 36 in. × 42 in. or Tilghman "Tumblast" 48 in. × 72 in. Rotary Barrel Cleaning Machine. JAMES BATES & SONS, Winsford, Cheshire.

FOUNDRY LADLE. One 4-ton capacity geared tilt Foundry Ladle required in good condition. Box FL375, FOUNDRY TRADE JOURNAL.

WANTED—Several Circular Moulding Boxes, 5 ft. to 9 ft. diameter. Also 600 lbs. capacity Tilting Furnace. Box WS368, FOUNDRY TRADE JOURNAL.

OIL FIRED HEAT TREATMENT FURNACE required, hearth size approximately 4 ft. 3 in. × 4 ft. 6 in. Suitable for annealing, normalising and tempering. Full details please to Box OF376, FOUNDRY TRADE JOURNAL.